JAN 29 1925

The ELECTRICAL REVIEW

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M.E.M.
See page xi.

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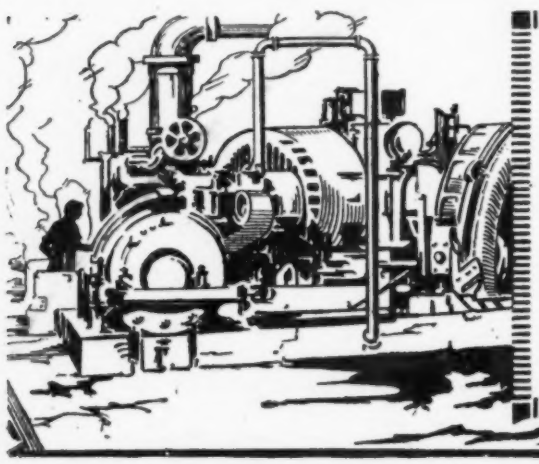

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Raw Materials for the Electrical Industry.

ON a later page of this issue we publish curves showing the fluctuations that have taken place in the prices of electrolytic copper, lead and rubber, all important materials for use in electrical manufacturing, during the years 1923 and 1924.

In placing these charts before our readers for comparative purposes, perhaps enabling them to avail themselves of actual facts when exercising their imagination with regard to probabilities in the near future, we may offer a few observations on the general position of each of the named materials as it appears to experienced market minds.

The outlook for copper is brighter at present that it has been for a very long time past. The last few weeks have witnessed a substantial advance in the price, and the chances run strongly in favour of 1925 providing a distinctly higher average value than the year which has just ended. Consumption the world over is improving. It has been broadening by very slow stages for months past, but with the exhaustion of the post-war stocks of scrap, demands have had to be filled to an increasing extent by new metal. Hence, conditions in the world's markets have become more normal, and the upward tendency of prices is merely the reflection of formerly obscured trade impulses. Increased consumption for electrical purposes is, of course, a strong underlying factor. The extent to which this is affecting the situation is shown by the fact that American consumption increased from about 7 lb. of copper per head of population in 1912-1914, to 9.6 lb. per head in 1921-23, due, it is stated, to increased electrical developments, coupled with the expansion in the use of motor-cars. The unsold stocks of copper in America and Europe are very moderate relatively to production and consumption, and to-day there seems not the least need for anxiety as to their assuming a burdensome

character. At the worst they furnish a reserve without which it would be impossible to carry on uninterruptedly the manifold processes and functions of consumption.

American trade, after undergoing a reactionary period, has begun to improve again. Europe generally is in a stronger position than at any time since the war, while there is still room for vast improvement both politically and industrially, with its inevitable reaction upon the consumption of metals. As things settle down further, so progress will continue to be made. The growth of the electrical industry is mainly responsible for the improvement in the copper outlook, and as readers of this REVIEW know better than anybody else, this development fortunately shows no sign of being checked. There is, however, a potential supply from new and existing properties which, if fully utilised, should suffice to cover all likely needs.

Lead is in very much the same position as copper, but it came under the influence of normal trade factors more rapidly than did the red metal. The post-war stocks of virgin and scrap lead were much less formidable and more easily dispersed than those of copper, and since they were distributed, the world has had to face an ever-increasing scarcity of supplies. It is remarkable, indeed, that lead production should have failed so conspicuously to respond to the stimulus of high—indeed very high—prices. True, world output increased a little in 1924 over 1923, but not to anything like the extent to be expected, and one wonders sometimes if the vague but persistent tales of manipulation of output and supplies have any foundation in fact. Be this as it may, the course of lead prices and of lead production has formed a fruitful topic of discussion during the past year. As things stand to-day there is no relief in sight from the scarcity of metal, and from the extravagantly high prices current. North America may be expected to contribute a little more liberally this year than last, but all hopes hitherto entertained of Spain, Australia and Burma substantially increasing their quotas have been disappointed.

Tin is regarded in a most optimistic light. This metal is the most speculative of all, and is never free from the influence of a group of speculative operators, whose tactics for years past have been directed towards pushing up prices far beyond their true level and then smashing them to an unwarrantably low figure. This is what happened last spring and will no doubt happen again this year when the time seems ripe. In our opinion tin at about to-day's price, say £270 to £275, is pretty fully valued, even admitting the improved statistical position compared with a year ago.

Spelter is in a strong position, mainly on the problem of ore supplies. Metal is really scarce, and European smelters have failed to keep pace with European demands. Hence, relatively large drafts have been, and are still being, made upon the United States, a state of affairs likely to last indefinitely. Prices can hardly lose very much ground whilst current conditions are maintained, and the chances of radical alteration are somewhat remote.

A moderately higher average price for rubber for 1925 than that recorded for 1924 is predicted with complete confidence. The market stands to-day in a vastly different position from that ruling when the Stevenson scheme for the restriction of exports was inaugurated at the beginning of November, 1922. Prospects are regarded as encouraging, and there is a good deal of optimism in America, especially as to progressive activity in the automobile industry, which is, of course, the chief consumer. Should demand only be maintained at previous levels, however, the position should continue to improve, as despite a much larger production in the Dutch East Indies in 1924, the world's stocks last year decreased probably 50,000 tons. Moreover, practically all the 1925 output of the native producers in the Dutch East Indies has been sold already. There are now no serious surplus stocks to hamper the working of the Stevenson scheme, and its provisions for regulating the supply of rubber from Malaya and Ceylon according to the price should, consequently, go far towards maintaining equilibrium.

While the recent top prices may not be maintained, as these were occasioned by extraordinarily heavy buying on American account for replenishing depleted stocks, it is probable that an average of at least 1s. 3d. per lb. will be seen, ensuring the liberation of increasing quantities of rubber under the provisions of the restriction scheme. To sum up, the rubber market is in a better position than it has been for several years.

The Kearney Railway.

THE reception of a deputation from the "Kearney Society" by Col. Moore-Brabazon, M.P., Parliamentary Secretary to the Ministry of Transport, last week brought the Kearney high-speed railway scheme once more prominently before the public. No reporters were present at the interview, and the account of it that was circulated by a news agency was modified after publication in important particulars.

It was alleged that the Kearney Society represented "nearly five million people who urged the advantages of the Kearney system of tube railway." The president, Lord Headley, explained that the special purpose of the moment was to get the Government to guarantee sufficient capital and to grant powers to enable the first section of the Kearney tube railway to be constructed—a most laudable object, from the point of view of the inventor, Mr. E. W. C. Kearney—and suggested short railways under the Tyne and under the Thames respectively as suitable schemes.

Those who have not read or do not recollect our articles of 1908 and 1910 on this subject may be interested to know that the Kearney system is a switchback railway; the stations are near the surface, and the intervening sections run down to a depth of 100 ft. or so at a gradient of one in seven, and up again to the next station, the trains reaching a speed of 50 miles an hour at the foot of the gradient. The trains run on a single rail, being guided by a second rail overhead.

At the time when the system was introduced, we pointed out that both ideas were old, and we indicated some of the objections to what we described as a "hare-brained scheme." The grading system was adopted to a small extent in the construction of the Central London Railway, but the experiment was never repeated; as stations must always be on level track, no help is obtained from gravitation when it is most needed. As for the guide-rail scheme, which we first described in 1883, we know of no railway in the world that has used it. That is not put forward as proof of its unsoundness, but indicates at least that no railway company has been convinced of its advantages. Obviously through running with other railways would be impracticable.

As for the "Kearney Society" and its five-million *clientèle*, we take it that these good people are the residents of the many London suburbs which have not adequate transportation facilities, who would jump at anything that seemed likely to afford a solution of their difficulties. So far as the merits of the system itself are concerned, the five millions count for nothing; but they have our sympathy, and we hope that more rational means will be found to supply their wants. Of the Kearney system our opinion has not changed since we first commented upon it, and we should emphatically object to any proposal to give the support of the State, whether in the form of funds or guarantees, to such a project.

Hull and British Industry.

HULL is the latest city to whose credit lies a decision not to place its orders in Germany under the prevailing conditions. The Telephone Committee recommended the acceptance of a German tender for cables, but when the matter came before the City Council last week it was referred back for reconsideration

with a view to the acceptance of the lowest British offer. No doubt the Committee felt that on price alone it was doing its duty in putting forward the low Continental tender for adoption, but the City Council as a whole was able to take other considerations into account and allow itself to be influenced by the need for assisting British industries to provide continuous employment. Some members of the Council expressed themselves very emphatically, one describing German competition under present conditions as "dastardly." The improvement of the situation in Central Europe, the preparation of new Commercial Treaties and Reparations discussions have introduced an atmosphere which has encouraged increased activity on the part of those who desire to see a return to "normal" international trading relations, but readers who have not short memories will desire to avert a return to the state of affairs—"normal" can it be called?—in which British electrical interests were penetrated Teutonically. The municipalities which have the control of much public expenditure can do something to safeguard our industries. Schemes taken in hand, with State backing under the Trade Facilities Act, have that backing because it is desired to facilitate British trade and so to reduce unemployment, and surely it is only consistent for public works, behind which there is the backing of the general body of the ratepayers, to be placed where they will afford the maximum employment of British workpeople. Nobody will suggest that the British electrical cable-making industry stands in need of assistance to meet fair and legitimate competition. It is the strongest of all departments of the electrical industry, and on price and quality combined under ordinary conditions of international trade it is quite capable of holding its own. But the times are not normal; labour rates, hours, and conditions are not comparable; and until they are, solicitude for the interests of our unemployed is fully justified.

Company Law.

IT is a wise decision on the part of the President of the Board of Trade to appoint a committee to consider and report upon the amendments that may be regarded as necessary in the Companies Acts, 1908 to 1917. The appointment is welcomed by the financial Press, which describes it as a continuation of the Wrenbury Committee of 1918. Publication of the recommendations of the Committee that has been inquiring into bankruptcy matters is promised at an early date, and it will be possible to give the report consideration while the subject of limited liability concerns is receiving attention from the new committee. A committee is also engaged in investigating the Insurance Companies Acts, so that we have inquiries in progress regarding three important sections of our business life. Experience has shown that the law affecting both private firm businesses and companies is being abused in various respects. It is impossible to guard the innocent and the uninitiated against every artifice, subterfuge or piece of recklessness, but it is only right and proper to do what we can, in reason, to handicap the wrong-doer, to protect the investor, to ensure clean and secure trading, and to maintain a spirit of commercial and financial confidence. Prospectuses that have been through our hands have made us wish that a censorship of such documents could be established so that the guileless public of both sexes might be protected in advance instead of being destined to hear the sorry tale of a liquidator after their possessions have vanished. Yet nothing that unnecessarily limits or restricts initiative or freedom of enterprise or introduces irritating "controls" can be entertained. The constitution of the new Committee is a safeguard against harmful prohibitions. It consists of prominent men connected with banking and the Stock Exchange, industry, and accountancy, and includes at least two well known electrical directors—Sir Edward Manville, whose interests are manifold, and the Hon. H. Brand, who is on the board of four or five electric supply undertakings in the Tyneside area.

Pulverised Fuel and Grits.

HITHERTO the chief argument against the use of pulverised fuel appears to have been the fear lest the district surrounding the power station should be "snowed under" with impalpable dust. By the irony of fate, the situation has been reversed at one centre, at any rate.

The Electric Supply Committee of the Corporation of Birmingham has for some time past been making experiments, with a view to checking the nuisance to residents in the vicinity of the Prince's generating station (Nechells) arising from the emission of grit, and last week the Chairman informed the Birmingham City Council that there had been a recurrence of the trouble recently. Early last year the committee had before it a promising device for stopping the nuisance, but could not get delivery, and decided to adopt a more expensive class of coal which was less likely to cause trouble. The change-over was made at great cost, but in the middle of November, complaints again began to come in; grits were falling at a considerable distance from the station. There was no apparent reason why the nuisance should occur sometimes and not at other times. Investigations were in progress, but the problem had not been solved. In the meantime other people had installed a type of grit catcher which had proved successful, and the committee was going to try it. In the United States, he said, great use was being made of pulverised fuel from which the dust which was given off was so fine that it floated away; Mr. R. A. Chattock, the City electrical engineer, went to America to inspect the plant, and was very much impressed with what he saw. As a result, one set of boilers was going to be fired with pulverised fuel, and it was hoped that this would solve the question so far as new boilers were concerned. The committee had spent over £14,000 in trying to catch the grits, and had not yet succeeded in doing it—nor had anybody else, except by pulverised fuel. In addition it had spent an extra £35,000 on the more expensive coal. If the grit catcher was found to be successful, it would be applied to all chimneys built on the existing system, and that would cost between £10,000 and £11,000. At the Nechells station 500 tons of coal was consumed per day, and there was bound to be a certain amount of dirt given off.

Thus Birmingham is seeking salvation from the grits emitted with mechanical stokers by turning to the "impalpable dust" of pulverised fuel! The result will be awaited with keen interest by station engineers.

Three-Wire Mains.

A LENGTHY discussion followed the reading of an interesting paper on "Three-Wire d.c. Distribution Networks," by Mr. H. W. Taylor, before the Institution of Electrical Engineers, on January 8th, which is abstracted in this issue.

The salient point of the discussion appeared to be the loading of cables for use as feeders. While "Kelvin's law" should be adhered to where possible, the question often resolves itself into one of voltage drop *versus* heating effects, and it may be claimed that either of these is the deciding factor under particular circumstances. The Electricity Commissioners impose no limit of pressure drop on feeders, but their regulations as to the pressure on consumers' premises must be taken into account, and the consumers' interests must be studied.

A suggestion for the looping-in of the neutral to consumers' premises was much criticised, it being contended generally that it would be impracticable to obtain access to the consumers' premises for testing purposes. The suggestion reminds us of a scheme put forward in our pages in June, 1920, by Mr. H. Wilson, who proposed to loop a twin distributor cable into every house in laying out the supply system for a large housing scheme, thus providing for the balancing of the three-phase four-wire system, giving a duplicate supply to each house, and facilitating the localising of faults.

Electricity in Mines.

The Reports of the Secretary for Mines and H.M. Chief Inspector of Mines for 1923.

THE third annual report of the Secretary for Mines, together with the annual report of the Chief Inspector of Mines, is issued as one volume at the price of 6s. 6d., but it is with great pleasure that we notice that the report of H.M. Electrical Inspector of Mines is issued as a separate publication at the price of 6d. We have no doubt whatever that this will be greatly appreciated not only by the electrical staff employed at the collieries, but also by managers and colliery workers generally.

From the report of the Secretary of Mines we learn that, owing mainly to the dislocation of production in the Ruhr coalfield, 1923, the year was a prosperous one for the British coal-mining industry. Output was higher than in any previous year except 1913, and work seven hours instead of eight as in 1913. Unfortunately, however, it was the exporting collieries that benefited mostly, and no improvement was reflected in the general trade of the country. Also it was mainly the newer and more efficient collieries which reaped the benefit. For instance, in Yorkshire, Derbyshire, Nottingham, and Leicester the outputs exceeded the outputs of 1913, but in all other districts, with the exception of Kent, the output was lower; the difference amounted to half a million tons in Northumberland, Staffordshire, Salop, Worcester, and Warwickshire district, 2.6 million tons in South Wales and Monmouthshire, 3.3 million tons in Durham, 4 million tons in Scotland, and 4.6 million tons in Lancashire,

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DISTRICT.	Total Number of Mines at Work.	Number of Mines at which Electrical Equipment is installed.	Aggregate Horse Power of the Electric Motors in use. BELOW GROUND. Haulage.	Pumping	Portable Machinery.	Miscellaneous.	Total.	ABOVE GROUND. Winding.	Ventilation.	Haulage.	Coal Washing or Screening.	Miscellaneous.	Total.	Total Below and Above Ground.
1. Northumberland ...	124	73	14,246	15,536	4,708	1,063	35,553	7,529	6,602	1,839	3,706	13,100	32,776	68,329
2. Durham	288	171	50,449	52,277	5,932	3,865	112,523	16,147	20,957	13,363	16,806	49,045	116,318	228,841
3. Cumberland and Westmorland	36	21	1,689	2,207	513	1,057	5,466	115	954	150	2,238	2,294	5,751	11,217
4. Lancashire and Cheshire...	253	126	15,834	17,562	1,416	673	35,485	6,880	5,535	1,687	6,035	12,776	32,913	68,398
5. Yorkshire, South ...	135	78	21,935	15,470	2,816	3,964	44,185	1,160	10,637	3,239	17,360	41,959	74,355	118,540
6. Yorkshire, West ...	185	97	11,558	7,879	4 156	1,134	24,727	1,585	2,582	1,167	6,809	10,238	22,381	47,108
7. Nottinghamshire ...	40	35	12,936	3,076	6,004	286	22,302	57	2,871	806	4,748	7,979	16,461	38,963
8. Derbyshire (except South Derbyshire)	120	56	13,674	8,851	3,286	573	26,384	1,242	3,202	1,041	5,048	11,034	21,567	47.951
9. Derbyshire, South ...	14	12	1,752	866	458	47	3,123	—	—	266	180	212	658	3,781
10. Staffordshire, North...	82	30	8,244	9,336	1,245	720	19,545	245	1,955	1,131	2,537	7,672	13,540	33,085
11. Cannock Chase ...	31	26	6,963	1,284	2,664	276	11,187	1,350	322	966	2,011	2,394	7,043	18,230
12. Staffordshire, South, and Worcestershire	141	23	509	1,884	180	129	2,702	170	150	286	158	514	1,278	3,980
13. Leicestershire... ...	28	17	1,935	651	615	—	3,201	—	—	283	360	694	1,337	4,538
14. Warwickshire... ...	27	21	7,012	2.875	1,141	220	11,248	—	441	623	1,174	2,427	4,665	15,913
15. Shropshire	59	8	353	454	286	—	1,093	—	30	64	140	263	497	1,590
16. Forest of Dean ...	60	9	1,449	7,317	120	86	8,972	—	157	149	120	426	852	9,824
17. Somerset	19	12	1,157	801	46	135	2,139	—	55	60	97	352	564	2,703
18. Bristol...	5	4	1,177	779	42	55	2,053	—	265	75	25	258	623	2,676
19. Kent	4	3	425	3,786	82	54	4,347	—	80	—	166	731	977	5,324
20. South Wales and Monmouth	660	372	74,558	79,758	2,411	2,520	159,247	45,480	28,666	25,854	16,121	73,042	189,163	348,410
21. North Wales	42	18	2,914	2,101	1,187	285	6,487	—	614	270	337	1,848	3,069	9,556
22. Fife, Clackmannan, Kinross and Sutherland	70	61	14,206	26,030	9,479	2,501	52,216	4,133	1,882	884	3,595	5,740	16,234	68,450
23. Lothians (Mid & East)	39	33	7,683	14,131	2,546	1,921	26,981	208	1,461	943	1,044	4,694	8,350	35,331
24. Lanarkshire, Linlithgow, Stirling, Renfrew and Dumbarton	309	221	30,457	43,376	28,103	3,516	105,452	2,577	4,856	4,353	6,029	8,421	26,236	131,688
25. Ayrshire, Dumfries and Argyll	94	51	4,540	10,233	2,713	388	17,874	550	948	391	1,649	1.638	5,176	23,050
Great Britain ...	2,902	1,594	312,225	333,140	82,257	25,516	753,138	91,810	96,456	63,079	99,126	261,136	611.607	1,364,745
Corresponding figures for 1922	2,911	1,557	283,616	313,076	68,886	24,448	688,026	76,248	89,207	59,475	87,746	239,472	552,148	1,240,174

exports surpassed even that record year. Prices were good, and earnings improved on the low level of the preceding year. The total output of coal for 1923 amounted to 276 million tons, as compared with 249⅔ million tons in 1922 and 287½ million tons in 1913; the weekly output of coal never fell below 5½ million tons, and in one week in April it rose to 5,825,000 tons, and in one week in December to 5,956,000 tons.

In view of the fact that the officials of the British Miners' Federation and legislators with Socialistic leanings have repeatedly informed the public that the coal-mining industry in this country is decadent and behind the times, and that so long as the mines are owned and controlled by the present capitalistic owners there will be no progress, we think the facts speak volumes for the owners and managers, seeing that an output has been obtained so closely approaching the output of 1913, in spite of the fact that the miners Cheshire, and North Wales. Employment in the mining industry was good, there being at the beginning of 1923 only 4.5 per cent. of the insured coal miners unemployed, and at the end of the year that number had fallen to 2.4 per cent. This compares very favourably with the corresponding figures of 12.7 per cent. and 10.7 per cent. respectively for industry generally.

As to the coal produced, 78 million tons which, together with 4 million tons of coke, equals 83¾ million tons of coal, was exported, against a similar equivalent of 75½ million tons of coal in 1913; 168¾ million tons was available for home consumption, including 23¼ million tons used at the mines, or supplied to the miners, but not including coal which was used in the manufacture of coke and patent fuel subsequently exported. This was 11 million tons more than in 1922, partly due to the temporary stimulation of the iron and steel industry by the events in the Ruhr, and by

the unseasonable weather, but it is a regrettable fact that the total home consumption was less by 15 million tons than in 1913.

Much information is given regarding wages paid in the several districts under the National Wages Agreement of 1921, and an analysis of the figures seems to show that although prices improved and "costs other than wages" were reduced owing to the effect of the "minimum wage" during the year 1922, wages did not improve so much as they might have done. But it only shows how impossible it is to attempt to put the whole industry on one footing, as even with the good trade of 1923, out of 13 districts eight made a profit of from 7d. to 2s. 9d. per ton, while five made a loss of from ¾d. to 1s. 7¼d. per ton, and the wages paid as a "percentage of the net proceeds" varied from 81½ to 112 per cent. The average was 85 per cent., against 92½ in 1922. It is easy to see, therefore, that in those districts where even in a good year they cannot make a profit, due to the minimum wage fixed by the National Agreement, in a poor year many of the collieries cannot go on losing money and must close; the present year has seen many such stoppages, and in all probability most of the mines will never open again.

It may be interesting to record the average proceeds and costs for the four quarters of the year 1923:—

	March.	June.	Sept.	Dec.
	s. d.	s. d.	s. d.	s. d.
Proceeds	18 11¼	20 5¼	19 10¼	19 10¾
Wages	11 6¾	11 11¼	13 3¼	12 7¾
Stores and timber ...	2 1	2 2¼	2 3	2 2
Other costs	2 5¾	2 7¾	2 10¼	2 8¾
Royalties	0 6¼	0 6¼	0 6¼	0 6
Total costs of production	16 6¼	17 2¼	18 10	17 11¼
Credit	2 5¼	3 2¾	1 0¼	1 11½

Out of the credit amount has to be met interest on debentures and other loans, capital adjustments under the Finance Acts, corporation profits tax, and owners' profits subject to income tax and super tax.

Activity in the exploration of new areas and the development of proved coalfields was also well maintained during the year. Several new pits were finished and several more commenced.

The use of electricity grows apace, the total horsepower installed in 1923 being 1,364,745, against 1,240,174 in the previous year, an increase of no less than 124,571 h.p. In the table below we give particulars taken from the separate report of H.M. Electrical Inspector of Mines. It will be noted there is a big increase in haulage, portable machinery, which includes coal-cutting machinery, and winding:—

Coal-cutting Machinery.—With regard to coal-cutting machinery, there were in use at 857 mines, out of a total of 2,902 mines at work, 6,159 coal-cutting machines, as against 5,434 in 1922, or 725 more. Of these, 2,745 were driven by electricity and 3,414 by compressed air, and the total tonnage of coal won by the machines was 47,526,439, against 38,124,122 tons in 1922, being 17 per cent. and 15 per cent. of the total output respectively. The following table gives particulars of the machines in use and quantity of mineral cut:—

DETAILS OF COAL CUTTING MACHINERY AND QUANTITY OF COAL CUT.

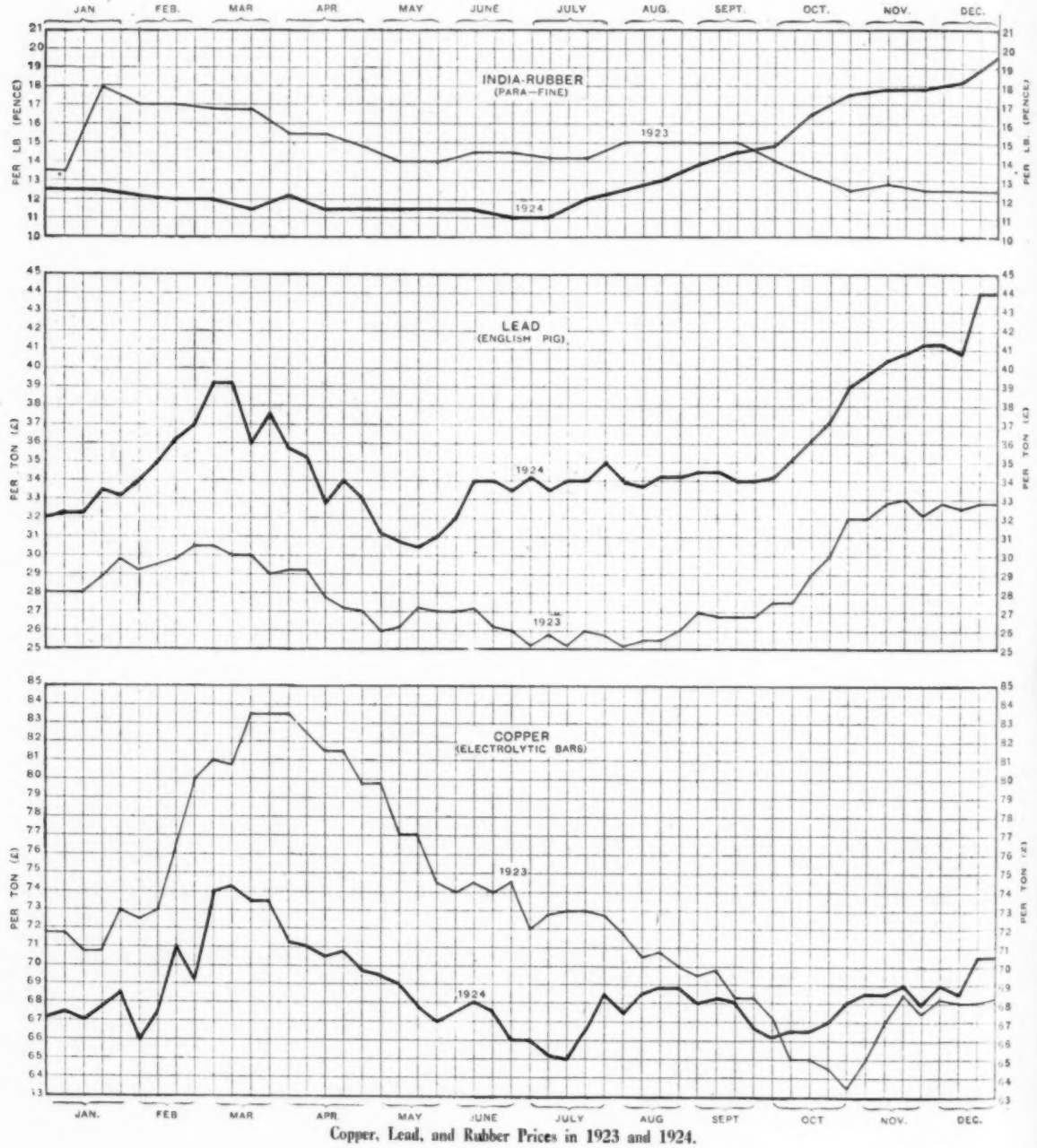
District.	Machines in Use.				Driven by Electricity.	Driven by Compressed Air.	Total number of Machines.	Tons of Coal Cut.				Total.	Percentage of Total Output.	Number of Conveyors at Coal Face.
	Disk.	Bar.	Chain.	Percussive.				Disk.	Bar.	Chain.	Percussive.			
1. Northumberland	71	26	106	362	162	403	565	810,521	233,848	1,052,093	1,414,585	3,511,047	25	25
2. Durham	27	55	220	685	188	802	990	233,883	489,163	2,256,349	2,339,083	5,314,544	14	103
3. Cumberland and Westmorland...	1	9	16	6	20	12	32	9,699	58,127	114,292	35,497	217,615	12	2
4. Lancashire and Cheshire...	106	85	81	550	50	772	822	752,925	619,032	596,086	1,081,474	3,049,517	15	50
5. Yorkshire, South	31	30	148	136	96	249	345	395,234	679,877	1,778,541	287,344	3,120,996	10	108
6. Yorkshire, West	159	18	142	118	150	287	437	1,783,165	109,635	1,503,615	149,727	3,546,142	22	77
7. Nottinghamshire	40	53	130	16	188	51	239	315,330	378,405	1,293,913	19,750	2,007,398	14	13
8. Derbyshire (except South Derbyshire) ...	22	44	149	46	138	123	261	263,653	458,780	2,003,494	76,774	2,802,701	16	38
9. Derbyshire, South...														
10. Staffordshire, North ...	1	15	139	108	54	209	263	7,444	107,751	1,246,714	160,817	1,522,726	23	21
11. Cannock Chase	5	2	95	15	87	31	118	64,006	2,777	959,799	20,039	1,047,040	18	12
12. Staffordshire, South and Worcestershire ...	18	5	53	5	59	22	81	210,561	45,652	799,251	4,400	1,059,864	10	2
13. Leicestershire ...														
14. Warwickshire ...														
15. Shropshire	3	1	6	—	10	—	10	31,350	10,281	53,263	—	94,894	11	—
16. Forest of Dean ...														
17. Somerset	1	6	1	2	8	2	10	8,578	29,610	1,682	4,910	44,780	1	16
18. Bristol														
19. Kent														
20. South Wales and Monmouth	3	71	214	73	78	283	361	6,104	443,712	1,706,207	61,085	2,217,108	4	562
21. North Wales	14	20	34	29	38	59	97	59,391	324,271	268,182	42,131	693,975	21	5
22. Fife, Clackmannan, Kinross and Sutherland ...	156	89	71	14	292	38	330	2,226,229	913,380	1,008,789	15,385	4,163,783	47	54
23. Lothians (Mid and East)...	25	42	30	4	85	16	101	384,250	606,000	386,490	3,110	1,379,850	31	31
24. Lanarkshire, Linlithgow, Stirling, Renfrew and Dumbarton...	525	290	177	14	960	46	1,006	6,316,245	2,343,750	1,945,476	47,832	10,653,303	51	36
25. Ayrshire, Dumfries and Argyll	32	21	29	9	82	9	91	367,463	302,002	388,829	20,862	1,079,156	23	2
Great Britain	1,240	882	1,841	2,192	2,745	3,414	6,159	14,216,031	8,156,053	19,363,065	5,784,805	47,526,439	17	1,157
Year 1922	1,213	795	1,479	1,946	2,395	3,039	5,434	12,408,615	6,811,173	14,125,689	4,778,525	38,124,122	15	928

We also note that no fewer than 33,336 more electric safety lamps were introduced in 1923, making a total of 327,929 electric lamps in use, against 294,593 in the year 1922. This seems as though all new lighting equipment was electric, as there was only an addition of 357 flame safety lamps. The total number of lamps in use was 912,690, of which 584,761 were oil flame lamps. The figures for 1922 were 584,404 flame lamps and 294,593 electric, making a total of 878,997. We also note that 36,253,502 shots were fired by electricity.

In spite of the advance in the use of electricity, the number of horses and ponies employed increased, the total number employed in 1923 being 65,579, against 63,821 in the year 1922, an increase of 1,758. We think a great many of these could be removed by the substitution of small electric haulages with considerable economy. It is satisfactory to note, however, that, as a rule, the ponies are well cared for, though 145 cases of ill-treatment were reported.

Copper, Lead and Rubber in 1924.

THE accompanying curves have been prepared to show the fluctuations of the prices of three commodities which are of the first importance to the electrical industry. The principal curves relate to 1924, but a curve showing the movements in 1923 is also given in each case to enable comparisons to be made or conclusions drawn.



Copper, Lead, and Rubber Prices in 1923 and 1924.

It will be observed that the fluctuations of copper prices in 1924 were not so wide as in the previous year—the maximum was over £9 lower, while the minimum was 30s. higher. With the exception of the month of October, the variations in the prices throughout the respective periods closely followed one another, the peak being reached in March in each case.

The same feature characterises the curves illustrating the course of lead prices, these, in 1924, being consistently above the levels of the preceding year. In the three months July-September there was very little change, but at the end of that period prices began to climb, and the year closed with lead at a very high level—£12 above the price at the commencement of the year, and about £5 above the peak which occurred in March.

The rubber-price curve remained very flat until July when a rise set in which was continued until the close of the year, when the price was 1s. 7½d. per lb. Thus, after a long period of depression, rubber rose above the high price which prevailed at the commencement of 1923.

Electricity in Gold Mining.—Speaking at the annual meeting of the Sabie (Transvaal) Gold Mining Co., Ltd., in December, Mr. J. F. Ludorf (deputy-chairman) said that the company was looking forward to the commencement of the Government's electric power scheme, which would render a supply available to the mines. This would enable the directors to broaden their plans, and the scheme would confer an incalculable benefit upon all the mines in the district.

The Rupturing Capacity of Oil-immersed Circuit-Breakers.

By G. L. E. METZ.

IT is now an established fact that in power stations, or in any part of an electrical circuit, the rupturing capacity of an oil-immersed circuit-breaker for operation on such a system cannot be determined by the magnitude of the power of the circuit it controls, but must be arrived at from a consideration of the size of the station, or stations, behind it.

On the occurrence of a fault or short circuit on the system, a heavy current commences to flow in the portion of the circuit concerned, the magnitude and duration

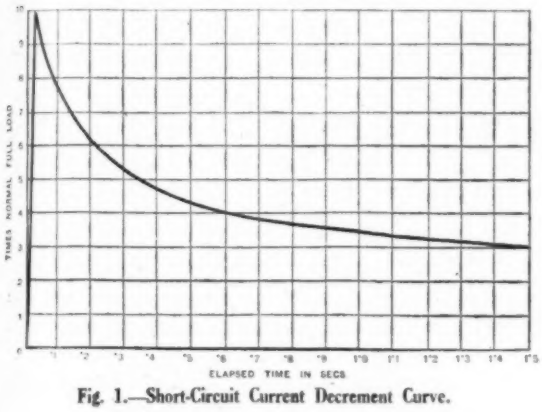


Fig. 1.—Short-Circuit Current Decrement Curve.

of which depend upon the plant capacity of the system, the short-circuit characteristics of the machines, and the impedance in circuit between the machines and the fault. It can clearly be seen, therefore, that faults of two different kinds are possible; first, when the impedance between the generating plant and the fault is negligible, as would be the case if a fault happened in the station itself; and, secondly, when there is considerable impedance between the generating plant and the fault, an example of which is a fault occurring at the end of a long feeder or in a sub-station located some distance from the power station.

Now, as the magnitude of the short-circuit current is inversely proportional to the impedance in circuit, it can be seen that oil-immersed circuit-breakers for operation some distance from the power station have to meet far less arduous conditions during times of short circuit, and need not therefore be so strong as those located in the station itself.

Naturally enough, every advantage must be taken of this fact if the gear put forward is to be efficient from a commercial point of view, which in these days is of prime importance.

The selection of a circuit-breaker therefore depends primarily upon the magnitude of the maximum short-circuit current that can occur at the point where it is to be installed in the system.

Whether an oil-immersed breaker is for operation actually within the power station, or some distance away, it is evident that as the abnormal currents that flow under fault conditions originate from the generating plant in the first instance, the short-circuit characteristics of the plant must receive consideration.

First, considering faults in or close to the power station, since the impedance in circuit is negligible, the only limiting factor will be the internal reactance of the machines themselves.

Now, the internal reactance of generators is usually known, or it can be obtained from the manufacturer, and when this is available the value of the short-circuit current can easily be obtained.

In order to observe and generalise the operation of modern alternators under short-circuit, Messrs. Hewlett, Mahoney and Bunham, of America, carried out a series of interesting experiments, and as a result it was found that the current at the instant of short circuit instantly attained a very high value, falling away more or less slowly to a lower sustained value following generally the decrement curve shown in fig. 1. This curve is drawn for a typical modern alternator having 10 per cent. reactance, quite a usual value.

It may be added that this curve is not the result of one test on an individual machine, but is really the summary of a number of tests made on modern machines.

An examination of the curve shows that the current at the instant of short circuit rises to a value ten times in excess of normal full load and dies down gradually to a much lower sustained value. From the fact that the curve is drawn to a time basis, it becomes evident that an oil-immersed circuit-breaker would have a much lower value of current to break if its action were delayed, rather than if it operated simultaneously on the occurrence of a fault.

Experience, however, has shown conclusively that a circuit should be broken as quickly as ever possible after the occurrence of a fault, even though this entails more arduous conditions for the oil-immersed breakers.

Recent developments in oil-switch design have all been towards increasing the operating speed, and it has been found that the contacts of a modern oil breaker will commence to separate in 0.2 second from the instant of occurrence of a fault when set for instantaneous operation, this time lag being due to the inertia of the moving parts.

Referring to fig. 1, it can be seen that an oil-

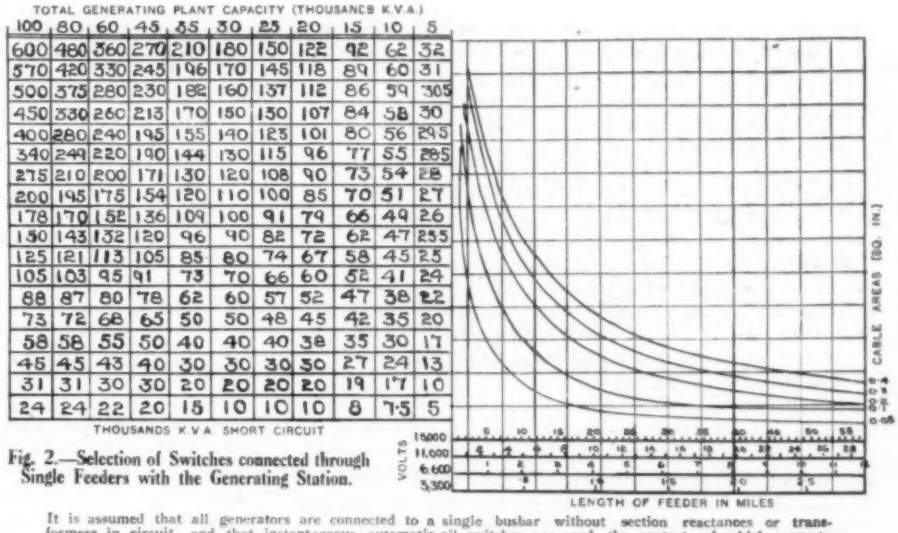


Fig. 2.—Selection of Switches connected through Single Feeders with the Generating Station.

It is assumed that all generators are connected to a single busbar without section reactances or transformers in circuit, and that instantaneous automatic oil switches are used, the contacts of which separate in 0.2 second.

immersed breaker has only to interrupt approximately six times the normal full-load current, as the short-circuit current has already died down to this value, this remark being true when the circuit-breaker is set for instantaneous operation.

In general, therefore, if an oil-immersed circuit-breaker is for operation in a power station, it should be capable of rupturing a short-circuit current of approximately six times the normal full-load current of the synchronous plant.

When an oil-immersed circuit-breaker is located some distance from the generating station, however, the impedance in series between it and the generating plant comes into consideration, and considerably reduces the magnitude of the short-circuit current.

Considering the very usual case of an oil-immersed breaker operating at the far end of a long feeder, the value of the short-circuit current will be limited by the impedance of the feeder cable, which must be obtained, and added to the total impedance of the generating plant. The result shows a great decrease in magnitude of the short-circuit current, which allows a very much smaller and consequently cheaper oil breaker to be installed.

It is a very laborious task to calculate each time for the magnitude of the short-circuit current, and several attempts have been made to obtain a general solution for simple circuits. Some time ago Mr. W. A. Coates devised a graphical means which was found to be very efficient and of great practical value. The writer has prepared a chart, fig. 2, based on similar assumptions to that already referred to, which is intended to solve this problem even more simply.

This chart is based on the assumption that all generators are connected to a single busbar, without section reactances, that there are no transformers between the generators and busbars, and that the oil-immersed breaker will operate in 0.2 second from the occurrence of the fault. Moreover, it is assumed that the generators are designed for a 3-phase, 50-period, a.c. system with 10 per cent. reactance.

The manipulation of the chart is quite simple. The distance from the power station to the location of the breaker is given in miles on the right-hand horizontal scale for cable at various voltages, from which point travelling vertically we meet the sectional area of the core of the cable in question, and thence travelling horizontally in a left-hand direction and stopping under the column which gives the plant capacity of the station under consideration, the rupturing capacity which the oil breaker requires will be read off direct in kVA at B.E.S.A. rating.

In addition to uses of this nature, the chart gives a very clear idea of the way in which the magnitude of the short-circuit power decreases as the distance from the station increases.

When the oil-immersed breakers are located actually in the station itself—that is, zero miles distance—it can be seen that the necessary rupturing capacity given by the chart is approximately six times the normal full load as already stated earlier, and as we proceed farther from the power station the decrease is plainly shown.

At this point perhaps a note of caution should be sounded. In connection with the rupturing capacity of oil switches it should be remembered that commercial obligations have to be met as well as technical. When a breaker is located at some distance from the station, there may quite possibly be two, or more, sub-stations between it and the power station, each having oil breakers. Where there are a number of lines of defence such as this, more risks can be taken, and the technical considerations can reasonably be made to give place to those of a commercial nature.

Recourse must be had to such methods only, however, when backed by sound engineering practice.

Engineering Concerns and Wembley.

"General Disinclination."

FURTHER information has been made public since we commented a week ago on the continuation of the British Empire Exhibition. Sir Travers Clarke, the chief administrator, forecasts special efforts to "Wake up London," Greater London not having been really "exploited" in 1924. Time will tell whether the people of London will show any greater enthusiasm for exploitation in 1925. Sir Travers promises a brighter and better spectacle, more gardens, more flowers, more flags, more music, more light, more variety in the restaurants (though there is as yet no caterer), a strengthening of the amusement features, rendering them more gay and more amusing; more of the club spirit, more of the family feeling. More of most things making for a grand popular entertainment—but what about exhibitors?

It will be remembered that in his speech in the City in November the Premier promised the support of the Government if others—including the great industries of the Home country—did their share. Sir Travers Clarke could not say at the moment what the Home country exhibitors were doing, but the firms which had such fine exhibits last year were being sounded.

The organisations which were responsible for the fine collection of exhibits in the Palace of Engineering last year had, however, sounded their exhibitors before Sir Travers delivered his speech, and it has been known for some weeks past that the achievement of 1924 could not possibly be repeated. Electrical and allied engineering firms are free to do just as they please in response to the appeal of the Exhibition Executive. There seemed at one time a possibility that exhibitors who took space in the large Section organised by the British Engineers' Association might take the plunge again in considerable numbers, but such a suggestion finds little support in the *Bulletin* of the B.E.A. which has just reached us. This publication contains reports of discussions, the result of the questionnaire, and correspondence between the B.E.A. and the Exhibition authorities. The conclusion of the whole matter is contained in two extracts that we will make.

First, from the B.E.A. letter to the Exhibition Secretary:—

> "The B.E.A. Exhibition Committee have decided that this Association cannot undertake to organise and manage a Shipbuilding, Marine, Mechanical and General Engineering Section again next year (1925). . . . There is good reason to fear that an Engineering Section . . . would be in the nature of an anti-climax, with which this Association could not afford to identify itself. . . . We greatly regret that the facts, by which our action must be governed, prevent us from again co-operating."

Secondly, from the B.E.A. notification to its members:—

> "It was decided (at the Council meeting on December 11th) that in view of the inadequacy of the support in sight and the general disinclination of engineering firms to incur the expense of exhibiting . . . . it would be better to leave it to the Exhibition Association themselves to dispose of the space in the Palace of Engineering.

While we have no desire to throw cold water upon the 1925 scheme, it is only right that the above decision should be placed on record here so that the electrical and general engineering trades may have a true knowledge of the actual position of affairs.

The Times states that the authorities intend to

specialise in steam transportation and housing in the Palace of Engineering, while a large part of the Hall will be occupied by an Excursion Dining Hall.

Our attitude in the past toward exhibitions has been critical of their value to industry when the amusement and entertainment sides have had to be made overwhelmingly attractive. From what has been said above it appears that the amusements are to be strengthened this year. We do not recall those of 1924 with enthusiasm, but we recognise that tastes differ widely. The "strengthening" of this side of the Show, while it may help to "exploit" the Londoner, will not incline the manufacturer to spend heavily on space.

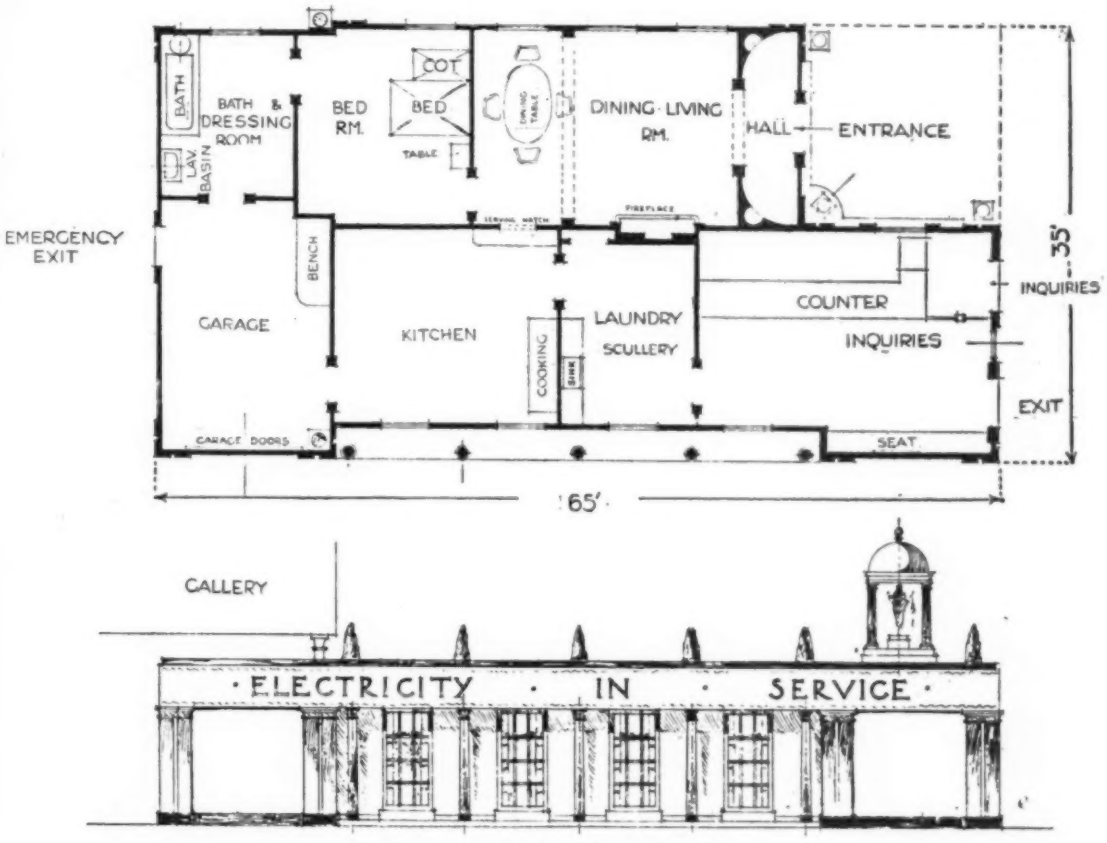
The burdens upon British manufacturing industry are such that it cannot afford to spend money purely in order to enable the Exhibition to have a run for a second period, though in some cases the firms, it is true, are big guarantors, and by spending on exhibiting they would hope to escape so heavy a payment in respect of their guarantees.

Electricity at the Ideal Home Exhibition.

THE inadequate part played by electricity in previous Ideal Home Exhibitions has given us cause for complaint. This year we should have no grounds for this form of dissatisfaction, for the British Electrical Development Association has taken the matter up and is pursuing it with as much vigour as that which led to the inspiring display at Wembley last year.

Mr. Beauchamp, the director and secretary of the Association, has sent us a preliminary plan of the arrangements which it is proposed to make at Olympia. We reproduce this herewith, and from it the reader will gather that, although the display will not be so extensive as that staged at the British Empire Exhibition, it will be nearly as representative. Every class of room of the modern dwelling will be reproduced, each with its appropriate electrical appliances, and there will also be a garage in which an opportunity for the display of electric tools will occur. The exits and entrances are so arranged as to permit the "free circulation" of the crowds which the display will attract. The plan, as at present prepared, illustrates a house which, apart from its electrical equipment, is a model of convenient arrangement. Electrically equipped, it should certainly typify the ideal home.

In the preparation of the display, the E.D.A. will have the active co-operation of the Electric Lamp Manufacturers' Association. This Association's recently-organised Lighting Service Bureau, which has been very much in evidence since its inauguration, will presumably take upon itself the task of providing appropriate lighting equipment in the various "rooms" into which the display will be divided. There is a wide scope available in this direction, and we look for a demonstration of what electric lighting should be. It is not too much to say that the success of the E.D.A. section will depend largely upon the treatment of the illumination, quite apart from the educational value of the methods of lighting adopted.



The Proposed E.D.A. Display at Olympia.

The throng that gathers at Olympia for this annual event is one in which the great majority is directly interested in the home—its design, its erection, its comfort, its convenience, its healthiness, its illumination, and so forth. Electric lighting, heating, cooking, vacuum cleaners, and other motor-driven domestic labour-saving appliances will all make a strong appeal, and they will be supplemented by radio apparatus. The support of the electrical industry is a foregone conclusion.

Selected Radio-Telephone Apparatus.

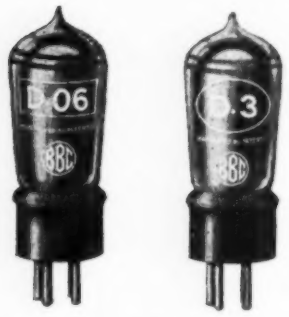
Recent Developments and Improvements.

Mullard Dull Emitters.

The Mullard Radio Valve Co. recently brought out six new valves of the "dull emitter" type. Three of these take a filament-heating current of 0.06 A, and can be operated with dry cells; they are known as the D.06 H.F. and L.F. and D.F.A.3, the first two requiring 3 V and the third 5.5 V.

The D.3 H.F. and L.F. valves take 0.3 at from 1.5 to 2 V, and the D.F.A.4 takes 0.2 at 5.5 V.

The D.06 H.F. and D.3 H.F. have similar electrical characteristics, the amplification factor being given as 17; both



Figs. 1 and 2.—Mullard Dull Emitters.

Fig. 3.—Cartridge Rheostat.

are suitable for h.f. amplification and as detectors. The impedance of each is 60,000 ohms. The D.06 L.F. and D.3 L.F. are also similar, having an amplification factor of 7 and an impedance of 15,000 ohms. All four are fitted with the Mullard moulded insulating cap (see figs. 1 and 2).

The D.F.A.3 valve is a power amplifier, with an impedance of 13,000 ohms. and an amplification factor of 7½; the D.F.A.4, on the other hand, is a high-impedance valve specially designed for resistance amplifiers, with an amplification factor of 20 and an impedance of 27,000 ohms.

Samples of these valves which we have received were very efficiently packed, and the valves are of strong construction.

A Micrometer Filament Rheostat.

A novel type of rheostat for the control of filament temperature has been received from the Enterprise Manufacturing Co., Ltd. Its special feature is the use of "cartridges," each covering a specified range of resistance. The cartridge consists of a small rubber tube closed by brass end-plates, and containing carbon granules. The resistance is non-inductive, and is unaffected by oscillatory currents; it gives a uniform gradual variation, and is suitable for all kinds of circuits. Owing to the elastic construction of the cartridge, which expands sideways when compressed endways, the carbon granules do not tend to pack solid. The cartridge is inserted in an ebonite tube and compressed by a screw with a suitable knob; the usual ranges are from 0 to 5, 10, 20, and 30 ohms for filament control, 0.2 to 5 and 5 to 10 megohms for use as a variable grid leak, and 25,000 to 50,000, 50,000 to 100,000, and 70,000 to 140,000 ohms as an anode resistance. The smoothness of variation of resistance, and the ease with which the range can be altered by changing the cartridges, make this a very handy and efficient rheostat. Fig. 3 shows a similar device, going up to 250,000 ohms.

Tests that we have made show that a range from the rated maximum resistance down to one-tenth of that value is covered by from one to two complete revolutions of the knob, but in some cases less than one revolution suffices; it would seem therefore that a screw with a finer pitch would be an improvement.

Marconiphone Two-Valve Power Amplifier.

The Marconiphone power amplifier (fig. 4) is practical in its uses; although essential where a great deal of power is required, the controls are flexible to permit of its being used more effectively in small rooms. It is a small cabinet instrument and employs two valves of the L.S.5 type in conjunction with two Marconiphone "distortionless" transformers, the ratios of which are 2.7 to 1 and 6 to 1 respectively. Provision is made for the employment of either one or two valves, determined by a three-position Dewar switch mounted on the face of the upright panel; this switch has also an "off" position. Variation of volume irrespective of the receiver tuning is accomplished by means of a tone switch having three positions. The panel is undisfigured by screw heads, &c., and a substantial bank of grid batteries is provided. Connection with the receiver 'phone terminal is made with a plug at the end of a loose lead, the other end of which is permanently connected to the amplifier. A small ebonite panel on the back of the instrument carries a pair of sockets for the attachment of the loud speaker and two sets of plugs for h.p. and l.p. battery connections. For the l.p. supply, a 6-volt accumulator of at least 40 ampere-hours will be necessary; the

Fig.4.—Marconiphone Two-Valve Amplifier.

consumption of the two valves is 1.7 amperes. The h.p. supply will consist of 4 banks of 42 volts connected in series, a total of at least 160. The voltage of the grid battery inside the instrument is approximately 16 and is furnished by four small type batteries. The polished mahogany cabinet has two folding doors.

The B4 Amplifying Valve.

The British Thomson-Houston Co., Ltd., has introduced a "dull emitter" valve, the "B4," which possesses qualities which render it specially suitable for power amplification. It has a low impedance and a high amplification factor, and is subjected to a special process in the course of manufacture for the purpose of obtaining an exceedingly high and permanent vacuum. The valve fits the standard socket, and consumes 0.25-A at 6-V; the anode voltage may be from 40 to 100 V. The accompanying chart shows the characteristic

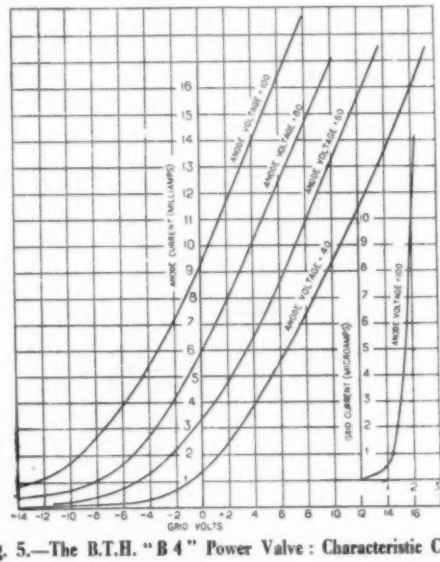


Fig. 5.—The B.T.H. "B 4" Power Valve: Characteristic Curves.

curves of the valve. The filament takes the shape of an inverted V, and is closely apposed to the flattened grid and anode. The valve can also be used as a h.f. amplifier, and as a detector, with an anode pressure not exceeding 40 V. Negative grid bias is applied when the valve is amplifying, from −3 to −5 volts according to the anode voltage.

Using B4 valves for both h.f. and l.f. amplification, we have obtained excellent results as regards effective range and loud-speaker reproduction.

The "Dulcivox" Loud Speaker.

FROM the Edison-Swan Electric Co., Ltd., we have received a sample of the "Dulcivox" loud speaker—an instrument of the "baby" type, for use in the average living room. In this device, the diaphragm is screwed to a brass ring, which is so pivoted under spring tension that by means of a milled-head screw the air gap between the diaphragm and the pole-pieces can be adjusted. The horn is of the swan-neck shape, and possesses very little resonance; using this instrument we have obtained exceptionally pleasing reproduction of broadcast music and speech, with ample volume for a fair-sized room.

Electricity Supply Undertakings.

A RETURN of authorised electricity supply undertakings in Great Britain has been prepared by the Electricity Commissioners. It is a list, in convenient form for reference, of the local authorities, companies and persons in Great Britain holding statutory powers to supply electricity, together with the salient administrative particulars of each undertaking as at December 31st, 1923.

In each case the titles and dates of the Orders or Special Acts authorising the respective undertakers are given, together with titles and dates of any additional special or local Acts containing provisions relating to the undertaking.

The areas of supply are shown in the return. In the case of local authority undertakers, where the original area has been re-named or has undergone alteration since the supply of electricity was first authorised, the area of supply is described in terms of the present local government areas. In the case of company undertakers the area is described, in general, in terms of the local government areas as constituted at the commencement of the Order or Special Act authorising the undertaking.

Information as to the date of commencement of supply is not given in some cases, either because the information was not furnished to the Commissioners in time, or because the supply has been commenced subsequently to December 31st, 1923.

The population of the authorised areas of supply has been given in terms of the 1921 census; but where undertakers supply only a part of a local government area, approximate figures are inserted.

The figures given under the heading "Assessable Value" relate to that value at April 1st, 1923, in the case of undertakings in England and Wales, and at May 16th in the case of undertakings in Scotland; the figures are confined to the areas of supply and are not given for the statutory areas of supply of power companies.

Particulars of maximum prices are given in the return; they are the prices prescribed by the original Order or Act authorising the undertaking, with any later modifications.

In cases where a local authority has the right of purchasing an undertaking, the return indicates whether due dates and the terms of purchase are those prescribed by Section 2 of the Electric Lighting Act, 1888, or whether special dates or terms are provided for by the Order, Special Act, or Deed of Transfer, or by any other statutory provision relating to the undertaking. Particulars are also given as to the acquisition or transfer of an undertaking, local government changes in name or area, and bulk supplies received or given.

A list of Electricity District Orders made under the Electricity (Supply) Act, 1919, and in force on December 31st, 1923, is a useful addition to the return.

Useful information as to the powers conferred on authorised undertakers by Local or Special Acts with regard to bulk supplies is contained in the appendices, and an alphabetical index of all place names referred to in the "Area of Supply" column renders the return a most useful and simple "reference sheet."

The Commissioners have under consideration the question of periodically issuing supplementary Returns in order to keep the volume up to date, as the complete Return will probably be re-issued only at considerable intervals.

The Return will be found an essential possession to all interested in supply industry areas and can be purchased direct from any of H.M. Stationery Office Depôts or through any bookseller, price 10s. net (postage extra).

Electrical Contractors' Dinner at Bristol.

THE members of the Bristol branch of the Electrical Contractors' Association (Inc.) and Allied Associations, held a successful dinner at the Royal Hotel, Bristol, on January 8th. Mr. A. E. Pendock, who presided, had the support of the president, Mr. Walter Riggs (London), Messrs. T. E. Alger (Newport), H. Wintle (Cardiff), R. A. Parsons (Gloucester), H. E. B. Lewis (Barry), W. B. Williams (hon. secretary), and others. Mr. L. G. Tate (general secretary) was prevented by illness from attending.

The toast of "The Manufacturers and Wholesale Traders" was proposed by Mr. Alger, who observed that the number of representatives present was evidence of the friendly feelings existing between them and the contractors. The interests of both were mutual, but there was room for improvement. He looked forward to the time when manufacturers would look upon the registered members of the Contractors' Association as the legitimate channel through which their commodities should be distributed. It was for the manufacturer and the wholesaler to boost the legitimate contractor in their own interest as well as that of the contractors, who had tabled their policy.

Mr. A. J. SKINNER, in reply, said that the manufacturers and wholesalers had already done a great deal to aid contractors. He was pleased to know that in the past year in the Bristol district the contracting business had been flourishing.

Mr. R. HODGE, proposing the toast of the Association, said that the feeling of confidence so desirable for success might be strengthened. Last year was more successful than 1923, and there were already signs that this year would be still better. The extent of that would depend on the alertness and enterprise of the contractors, who might so illuminate their windows as to show other traders what could be done. He deprecated the fact that contractors had let a large share of the wireless business get into the hands of outsiders, and suggested that they should make an effort to get it back as a legitimate branch of their business. Contractors were not as well organised as they ought to be. If they were chaotic, business would soon be a thing of the past.

Mr. WALTER RIGGS responded, and said he believed that their policy of co-operation would be endorsed by all, as they desired standardisation of discounts, fittings, &c., and co-operation between manufacturer and contractor to their mutual advantage. He dealt with various trade points, and said he did not think they were progressive enough in their displays of shop window lighting accessories. Steps were, however, being taken by manufacturers and contractors to remedy this, signal success having been achieved in some places by co-operative effort. They were up against a great difficulty in standardising wages, owing to variation in payments to different electrical workers. They did not want to cut wages down, but to stabilise them so that they might know where they were in contracting. As to wireless material, anyone who bought it to re-sell was regarded as a retailer, and the Association washed its hand of it. The ill-effects of inexperienced men handling the business had been apparent, and he was hopeful that it would get on proper lines. Increase of membership was rapid, having doubled in the last five years.

The toast of the Bristol branch was submitted by Mr. T. HOOD, who expressed sympathy with the general secretary of the Association in his illness. He urged members of the Branch not to nurse grievances but to disclose them so that they might be discussed and remedied. The greatest competitor they had was a Corporation works supported by the rates. They had had complaints of employés of the Corporation doing work in their spare time, which work was the prerogative of the contractor. It was not right that employés whom they helped to pay out of the rates should thus compete with them.

The CHAIRMAN, in response, said that they wanted all who employed labour in the electrical trade to become members of the Association. Interchange of ideas was very helpful and diversity of opinion of value in bringing forward matters of trade interest. When electrical mains extensions were contemplated by the Corporation, the Association was notified so that its members might be informed of prospective work. He commended the benevolent fund to support.

Legal.

Alleged Theft of Radio Valves.

AT the West Ham Police Court on January 6th, before Mr. Kenneth Marshall, Clarence Jones, draughtsman, and Herbert Golton, technical assistant, both employed by Marconi's Wireless Telegraph Co., Ltd., were charged on remand with being concerned together in stealing and receiving eight radio valves, valued at £5, the property of the M.O. Valve Co., Ltd. Police witnesses stated that Golton, who was employed to test the valves before leaving the works, had been kept under observation and was seen to hand valves over to the other defendant. They admitted that they had taken a number of valves in this way and after their arrest valves were found at their homes. The works manager of the M.O. Valve Co. identified the valves, but said that he could not swear that they had all passed the tests; some of them had.

The defendants, who pleaded "Not guilty," were committed for trial at the sessions, each being admitted to bail in £10.

Hill, Selby & Woodcock, Ltd., v. The Reliance Electrical and Maintenance Co.

IN the Mayor's and City of London Court, on January 6th, before Mr. Registrar Dell, Messrs. Hill, Selby & Woodcock, Ltd., merchants, 5, Philpot Lane, E.C., made a claim against the defendants, electrical engineers and contractors, Queen Victoria Street, for £8 10s. 5d., for two "Pallas" electric vacuum cleaners supplied. Mr. H. Strouts, solicitor, represented the defendants. Mr. F. W. SMURTHWAITE, managing director of the plaintiff company, said that the two vacuum cleaners were supplied to the defendants' order, but they were returned a week prior to the action. The defendants were written to and informed that the machines could not be accepted back, and their reply was that the machines were

delivered upon approval. In cross-examination, witness said that a circular had been sent out to the trade requesting that the machine might be tried upon approval and stating that it could be returned within seven days. Complaint had been made about one machine left and it was exchanged free of charge. No complaint had been made with regard to the other machine. Invoices had been sent to the defendants and up to the time of the machines being returned they had never been questioned. Mr. G. Cohen, proprietor of the defendants' business, said that he was offered a machine on approval and he agreed to take one to test. The cleaner was found to make a tremendous noise, and after being in use for an hour it would not suck. He made a report about it to the plaintiffs, and several appointments were made for plaintiffs' representative to call, but these were not kept. He had no recollection of the machine being exchanged; it had been adjusted. The plaintiffs' representatives were continually being worried about taking the machines back and told that the defendants could do nothing until they got a satisfactory machine. It was thoroughly understood that the machines were on approval. The REGISTRAR, after hearing the evidence, said he was convinced that the two cleaners were supplied to the defendants upon the representation of a traveller who had not been called as a witness. The traveller had explained to the defendants that if they would try to push the sale of the cleaners and business resulted it would be to the mutual benefit of both parties. Judgment was entered for the defendants, but in consequence of the delay in the return of the machines, no costs were allowed to the defendants.

Compensation for Loss of Employment.

SIR WILLIAM MACKENZIE, K.C., as referee under the Electricity (Supply) Act, 1919, in a claim against the Ayrshire Electricity Board for compensation for loss of office, has issued his award in the case of Mr. Robert Alexander, an employé of the Ayr Corporation electricity undertaking. Sir William finds that Mr. Alexander has suffered loss of employment in consequence of the transfer of the Ayr Corporation undertaking to the Ayrshire Electricity Board, and that under Section 16 of the Electricity (Supply) Act of 1919 he is entitled to compensation for loss of employment. His award is that the Board pay Mr. Alexander the sum of £102.

Theft of Radio Apparatus.

FINES of £7 10s. each, or two months' imprisonment, were imposed on H. M. Harvey and E. J. Hytch, at West Bromwich on January 8th, for the theft of a quantity of radio apparatus, valued at £22, from their employers, the Cable Accessories Co., Ltd.

Correspondence.

***Correspondents should forward their communications* at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

Good Loud-speaker Reproduction.

I am glad to see that attention is being devoted in the ELECTRICAL REVIEW to the question of good quality in loud-speaker reproduction, but unfortunately the article on the subject by Mr. R. Robert, in your issue of January 2nd, appears to me to contain some rather serious errors, which may undo the good done by bringing the subject to the notice of the public.

Leaving aside points where there may be ground for discussion, although your contributor makes definite statements, I will deal with points on which I believe the statements are not merely open to question, but actually erroneous.

(1) Mr. Robert recommends the use of 1-1 transformers for all stages after the first. This idea is a legacy of the old days when transformers were so bad that (since distortion is increased with ratio) the only safe thing was a 1-1. Nowadays one may use transformers suited to the valves, the ratio depending mainly upon the anode impedance of the preceding valve.

(2) Among the fixed condensers recommended is one of .01 to 1 microfarad across the loud-speaker. If the set is reasonably well designed this will almost certainly give unduly heavy tone. Such large condensers as these are only necessary if the set itself is abominably shrill.

(3) He recommends that "the valve-holders should be of solid ebonite, with legs widely spaced." What the last three words mean is a mystery to me, and in any case the valve-holders—especially for high-frequency valves—should not be solid, but open, to diminish capacity.

(4) He states that low-frequency transformers are perhaps responsible for 90 per cent. of the distortion in amateur-built apparatus. This may perhaps be open to discussion, but my experience is that the main trouble is the use of valves which have not the necessary output, at any rate where loud-speaker work is concerned.

(5) He states that reaction may actually improve the tone of a set. This appears to be so completely contrary to all theory, and such practice as I have ever met with, that I should like proof.

(6) "For really first-class loud-speaker results, the bright emitter stands unrivalled." This is a strong statement and one which I believe to be entirely unjustified by facts. I have measured the characteristics and performance of practically every British valve on the market to-day, and I find that as regards amplification factor and anode impedance there is, as would be expected, no essential difference between bright and dull valves. As regards output, the .06-type of valve is equal to the old "R," the .3-amp. 2-volt dull emitter rather better than the one or two modern bright valves, and the dull emitter power valves much superior to the few bright power valves in existence. I am prepared to justify these statements by actual figures if they are questioned.

(7) Mr. Robert suggests that the impedance of the valve should be approximately equal to that of the transformer. As a given transformer may have an actual working impedance of anything from a few thousand ohms up to several hundred thousand, according to the conditions in its secondary circuit, this statement hardly seems a sound one.

P. K. Turner.

London, *January 5th*, 1925.

With reference to the article on "Some Essentials of Good Loud-speaker Reproduction," published in your issue of the 2nd instant, we should like to criticise some of the author's remarks.

He states that "potentiometer control should be applied to the h.f. valve." We assume that the potentiometer should be used to control the grid potential. We would like to point out that a potentiometer used in this way introduces great damping effects, especially when a loose-coupled aerial is used, and such loose-coupling is essential for selectivity in cases where a h.f. valve must be used. Surely it would be much better to use a h.f. valve stabilised by the "neutrodyne" method?

Regarding ebonite, there is now on the market a brand of hard rubber which has a polished surface guaranteed to be free from surface leakage, which may be used instead of brands with matted surfaces, which do not have such a good appearance. Has the author any objection, apart from appearance, to paraffin waxed cardboard instead of ebonite? This material is strong and has a lower dielectric constant than ebonite.

Valve-holders should not be made of solid ebonite, as this introduces considerable stray capacities, which cause unstable and inefficient working of the set, and is, therefore, contradictory to the later statement that high-frequency valves having low inter-electrode capacity should be chosen. Valve sockets are better screwed directly into the panel itself, which should be cut away in such a manner as to leave a great an air space as possible between the sockets.

Further, with regard to the statement that bright emitter valves are better than dull emitters "for really first-class loud-speaker results" (*i.e.*, power amplification), and that the B4 type is perhaps the only exception to this, what other type of dull emitter is designed for power amplification? What is the force of the author's first statement?

We do not wish to disparage Mr. Robert's article in submitting these criticisms, but merely to raise a few interesting practical points.

Progress.

London, *January 6th*, 1925.

Replying to the letter of "Progress" printed above, I think I would agree with him that the "neutrodyne" method of stabilising the h.f. valves would be preferable to the use of a potentiometer. My object at this point was mainly to emphasise the necessity of some arrangement of this kind, whereby the tendency to self-oscillation might be counteracted. Regarding ebonite, I believe the brand mentioned to be quite satisfactory and certainly it has the advantage from the point of view of appearance. When I stated that valve holders should be of solid ebonite, I had in mind the usual type of socket such as one may see fitted on any average broadcast receiver, and my point was that these should be of ebonite in preference to an inferior "composition" material. Undoubtedly, however, where ultra-efficiency is aimed at, one of the various types of "anti-capacity" socket, having air spacing between the pins, might be adopted.

In reference to Mr. Turner's letter: he himself admits that "distortion is increased with the ratio." Certainly the best of the modern components designed for use in broadcast apparatus are those having a low ratio. The Sterling component with a 1-1 ratio was recommended because I have found it, in actual practice, to give exceptionally strong and distortionless amplification almost irrespective of the particular type of valve in use. I should not say that a condenser of, say, .01 μF capacity, would give an "unduly heavy tone"; rather the opposite; where the amplification was strong it would result in a considerable softening and sweetening of the tone. In any case this was a mere suggested value, the actual capacity of the condenser being largely a matter of experiment. Undoubtedly the use of unsuitable valves would make for distortion, but I still think that the greater part of the

trouble is to be traced to the use of shoddily-constructed high-ratio transformers.

Concerning reaction, this influences the tone of a set very considerably; and contrary though it may seem to all accepted notions, not always unfavourably.

I notice both writers have taken me to task over a remark concerning the dull versus the bright emitters. This is, of course, a controversial subject: but my own consistent experience has been that the dull emitters do not equal the best of the bright valves either for output or quality of reproduction. Apart from the question of performance, however, the bright valves are to be recommended as being more robust and—a minor point perhaps—considerably less expensive

R. Robert.

London, *January 10th*, 1925.

Electrical Trade Representatives.

Your contributor "A," in the issue of January 2nd, greatly interested me, as a buyer of electrical material and one who is not tied to the cheapest market in a great many instances.

I find on examination of my order book that I frequently hand my orders to about eight firms of factors and four of the leading manufacturers, and from a general point of interest it might be well worth your readers' while to see my point of view.

As contractors of very high standing with a high-class *clientèle*, my firm study service first, and in this connection we frequently find that the most useful representative to see us is the one who can spare time and trouble over the small details and concentrate upon us as though we were his only customer, without the feeling of financial results to himself being the prime factor.

The result is that in every case I have given my orders quite unconsciously to men who are, first, practical and original; and, secondly (and equally necessary), gentlemanly in manner and appearance, and sufficiently impressive throughout their conversation, as though their firm was behind them in every suggestion they make.

I learn that many of these representatives are paid well, and are not worried to death by the afternoon greeting of their own firm, "What, no orders again!" or some such remark from the chief.

Our own outside men receive a salary of £300 per year and a small commission over a certain amount, and in each case our representatives are practical, well-bred men (over 30 years), and are presentable everywhere.

We keep them in good and bad times, and in their own sphere they carry with them the courage and good feeling which we radiate on to their customers; consequently we can boast of being busy and hard at it all the time without worrying over non-paying public work.

As a buyer, believe me, I am well able to judge who stands out most in my own mind, and it is not a representative of a second-rate factor or a relentless employer of any kind—it is a happy man.

Buyer.

Tidal Power.

If Mr. Massey considers the efficiency of 42 per cent. obtained from the Forge-Catalane too low, it is difficult to see why he should refuse to accept the evidence in favour of the modern hydro-compressor which differs from its inefficient predecessor in the same way as a modern locomotive differs from Stephenson's "Rocket."

The figures which I quoted (and which Mr. Massey can easily verify from the references if he will take the trouble) represent the results of tests carried out by members of the staff of McGill University in the one case and of the Michigan College of Mines in the other. If Mr. Massey (who has not seen these reports before condemning them) refuses to accept them, I can only refer him to the classical reply of Dr. Johnson in a similar instance.

A. J. V. Underwood.

London, *January 12th*, 1925.

Windows as Newspaper Advertisements.

The electrical shop cannot profitably make use of the daily newspaper for the simple reason that 95 per cent. of what they are paying for is lost to them, by reason of the fact that a shop can only be in one street at a time and only a certain proportion of the readers pass down that street, unless it is the principal one of the town.

On the other hand, no electrical dealer should get the mistaken idea that advertising is not for him because he cannot afford to spend hundreds of pounds. It does not cost hundreds of pounds to have a well-dressed window and topical window cards and window strips. For a very few pounds, indeed, and by the exercise of originality and taste, your window can be an advertisement in itself.

January is a very dead month in all trades, and some special effort must be made if we are to pay expenses. People think they have no money to spend because they are just recovering from Christmas and its orgy of spending, but your windows can make them think differently.

Take, for example, electric irons; why not have a neat window card lettered with some such wording as this: "The day's ironing done in an hour at a cost of threepence" (or whatever the local current charge for this period happens to be)? Or take vacuum cleaners; you could have a window strip printed with some such message as: "A little child can work one," or "Plenty of leisure and cleaning a pleasure."

A good thought to bear in mind in wording advertising of any kind is that you must think from the user's point of view and not from your own. Don't tell people what your goods ARE, tell them what they can DO. The compelling appeals in selling electric helps are: More leisure for pleasure, save your hands, cut housework in half. These appeals will produce more business than all the cuts-in-price and blatant self-advertisement.

A watch should be kept on the marriage column, because very often the bride's future home address is given and a well-worded circular letter at the right time can make her a customer for the electrical goods that will help her to keep her house.

The electrical dealer has an opportunity offered few advertisers in that his goods help women to keep young, and there is no stronger appeal at the present day than that.

Donald Howat.

Glasgow.

Testing with Kenotrons.

I am pleased to have Mr. Gunstone's comments, and should appreciate any further remarks on the subject after he has perused the following.

The valves in question were specially made for the purpose of rectifying high-potential a.c., and they were worked at the full filament temperature stated by the makers. I do not consider that it would have been advisable to go higher without running a risk of overloading.

It can be considered that the purpose of the valves is to charge a condenser, two valves being used so that the whole a.c. cycle is utilised. This being so, the anodes must be at full positive potential with regard to the filament for some portion of the cycle.

The conditions are quite different to those obtaining in X-ray work, as the valves are used for a different purpose.

I quite appreciate that the risk is very small, as under working conditions the emission is not great, but I do contend that, when this class of apparatus comes into more regular and constant use, it is worth while investigating each installation so that the safety of the operators can be assured. The object of my article could have come under the heading of "Safety first."

I enclose my card in case Mr. Gunstone would care to discuss the matter at greater length.

James Nelson.

Prescot, *January 11th*, 1925.

Water from the Great Lakes.—The Supreme Court of the United States has granted an injunction against the City of Chicago restraining it from diverting a great part of the water from Lake Michigan for sanitation and drainage purposes. The quantity of water which has hitherto been so diverted by the City Sanitary Commissioners has amounted to 10,000 cu. ft. per second continuously, although under their permit from the United States Government they are only entitled to use about 4,000 cu. ft. per second. The result has been such a lowering of the lake levels as to interfere with navigation and power undertakings. The action was taken by a number of the Northern States, but the verdict also favourably effects the Dominion of Canada. Sir Adam Beck, chairman of the Hydro-Electric Power Commission of Ontario, stated recently that the loss of this water seriously affected Canadian hydro-electric development, and the injunction should lead to improvement in this respect.

The National Advisory Committee appointed by the Dominion Government to consider the questions related to the development of the St. Lawrence, recently held a meeting to draw up instructions for the joint board of engineers; these will be submitted for approval to the United States and Dominion Governments.

The Classification of Water Power.—A paper is to be brought forward for discussion at the Institution of Civil Engineers, on "Considerations in the Development of Water-power, with special reference to India," by Mr. B. D. Richards, B.Sc., M.Inst.C.E. The author suggests that a more useful classification of water-power schemes than by head, would be on the basis of storage provision, schemes being divided into storage, non-storage and partial storage schemes. A prominent consideration in Indian schemes is the question of balancing storage and how much storage to provide for the best economical development of the catchment area. The two variable factors are: the quantity of power and the volume of storage, and the limit of the former is that the average power is that corresponding to the average yield of the catchment area. Recorded data of yield factors for Indian catchments are few, and the experimental determination of factor for a catchment area is a complicated matter. India, however, possesses large potential supplies of water power at very favourable rates. With her vast supplies of raw materials and her teeming population, she has great industrial opportunities.

Business Notes.

The "Electrical Review" Index.—The Index for the last half-yearly volume of the ELECTRICAL REVIEW (July to December, 1924) is now being printed. Copies will be forwarded post free to those requiring them for binding or for reference purposes, if they will make application to the Publisher, ELECTRICAL REVIEW, 4, Ludgate Hill, E.C.4.

Bankruptcy Proceedings.—E. DOWNING, Osborne House, Regent Street, Willenhall, Staffs., moulder, lately trading with another at 143, Butts Road, Walsall, as manufacturers of electrical conduit fittings and general electricians.—The public examination of this debtor was held on January 7th, at the Wolverhampton County Court. The statement of affairs showed liabilities £404, against assets of 30s. Debtor stated that he commenced business in partnership with another, putting in £225. The business was not successful, and he had to file his petition. The examination was adjourned to be closed.

H. H. ATKINSON, electrical engineer, 33, Princess Avenue, Old Trafford, Manchester.—Receiving order made January 6th, on creditor's petition.

F. WILDE (Liverpool Engineering Co.), 18 & 20, Vauxhall Road, Liverpool.—Application for discharge to be heard February 6th, at the Court House, Liverpool.

B. BARNETT, electrical engineer, 104, Whitechapel Road, E.—Discharge suspended for two years (December 11th, 1926).

P. RUKIN, electrical engineer, 18, Mumford Street, West Bowling, Bradford.—Trustee, Mr. J. Draper, 69, Swan Arcade, Bradford, released November 25th, 1924.

S. L. BAFTY and N. MILES (Wireless Instrument Manufacturing Co.), wireless instrument manufacturers, Avenue Works, Avenue Road, Willesden Junction, N.W.—First dividend of 2s. in the £ payable January 14th, at 4, Charterhouse Square, E.C.

R. HAWORTH, electrical engineer, 19, Richmond Terrace, and 154, Duckworth Street, Darwen.—First meeting January 20th, at the Official Receiver's offices, 11, Winckley Square, Preston; public examination February 4th, at the County Court House, Blackburn.

J. E. ELLIOTT and J. M. ELLIOTT (J. E. Elliott & Co.), electrical engineers, 12, Broad Street, Oxford.—Last day for proofs for dividend January 23rd. Trustee, Mr. W. Boyle, Senior Official Receiver, Carey Street, W.C.

W. J. DUFFY, electrical engineer, 54, Gellatly Street, Dundee.—The public examination was to take place on January 14th, at the Sheriff Court House, Dundee.

B. L. BANKS & W. BANKS, electrical and wireless engineers, late of 13, Watergate, Rothesay.—The public examination was to take place on January 15th, at the Sheriff Court House, Rothesay.

Company Liquidations.—GLEVUM MOTOR & RADIO CO., LTD.—A meeting of members is called for February 11th at Eastgate House, Eastgate Street, Gloucester, to hear an account of the winding up from the liquidator, Mr. R. G. Kingscott.

NORTHERN RADIO CO., LTD., 19, Hopwood Avenue, Market Place, Manchester.—A meeting of the creditors was held on January 7th in London, when it was stated that on December 17th last the company passed the usual resolution for voluntary winding-up and appointed Mr. W. A. Appleton and Mr. W. L. Sibley as joint liquidators. No statement of affairs was presented, but it was reported that the unsecured liabilities amounted to £6,682. In addition there was a contingent liability of approximately £1,500, which was not at present admitted. The assets totalled £2,559 or a deficiency of £4,123. Mr. Sibley stated that the largest creditor was Radio Instruments, Ltd. (£6,360). The company had acted as the latter's agents and in order that the other creditors might be paid in full Radio Instruments, Ltd., was willing to stand aside. Discussion took place with regard to certain disputed claims and eventually the meeting was adjourned for a week in order that negotiations might take place with regard to them.

ELECTRIC AUTO-SUPPLIES, LTD.—A meeting of members is called for February 10th at 37, Great James Street, Bedford Row, W.C.1, to hear an account of the winding up from the liquidator, Mr. C. F. Bird.

STELLA CONDUIT CO., LTD.—A meeting of members is called for February 10th at the offices of Messrs. Gibson & Ashford, 39, Waterloo Street, Birmingham, to hear an account of the winding up from the liquidator, Mr. A. R. Miller.

BELLA PHONE CO., LTD.—A meeting of members is called for February 5th at Capel House, 54, New Broad Street, E.C., to hear an account of the winding up from the liquidator, Mr. F. W. E. Morgan.

BRITISH HUSH-A-PHONE CO., LTD.—A meeting of members is called for February 10th, at 106, Piccadilly, W., to hear an account of the winding up from the Liquidator, Mr. H. E. Reeke.

FOGDENS ELECTRIC CO., LTD., The Broadway, Leigh-on-Sea, Essex.—A meeting of the creditors in this matter was held on January 12th, at Leigh-on-Sea, when the chair was occupied by Mr. C. F. Farmery, who stated that the company had passed the usual resolutions for voluntary winding up, and appointed him to act as the liquidator. It was reported that the unsecured trade liabilities amounted to £329, while there were loan creditors for £311. The assets consisted of balance at bank £18, cash in hand £3, sundry debtors estimated at £50, stock-in-trade £236, valued at £100, office furniture £99, estimated to realise £50, and fixtures and fittings estimated to produce £50. The creditors decided to confirm the voluntary liquidation of the company with Mr. Farmery as liquidator.

Dissolutions of Partnership.—J. POLLOCK & Co., engineers, machinery merchants, and dealers in wireless and electrical apparatus, 63 & 65, Dunn Street, Newcastle-on-Tyne.—Mr. J Pollock and Mr. J. G. Kellett have dissolved partnership. Debts will be attended to by Mr. Kellett, who will continue the business under the same style.

ALBION ELECTRIC STORES, 9, New Station Street, Leeds.—Messrs. W. E. Collins, A. M. & E. Coates have dissolved partnership. Mr. Collins will attend to debts.

CRERAR & BANKS, electricians, 44, High Street, Irvine.—Mr. J. Crerar and Mr. C. Banks have dissolved partnership. Mr. Banks will attend to debts and carry on the business in his own name.

Trade Announcements.—The business of Messrs. ATKINS & POWELL, of Windsor, &c., mentioned under "Dissolutions of Partnership" in our issue of January 2nd (p. 13) has been purchased by Mr. A. Carter, of Electra House, Beaconsfield. It will be continued under the same style at 1, Thames Avenue, Windsor, where catalogues are required.

Mr. EDWARD BUSHEN, for many years manager, has acquired the business of Garnish, Lemon & Co., Ltd., electrical engineers, of Pilton Street, Barnstaple.

MESSRS. CUIRASS PRODUCTS, LTD., have removed to Abbey House, Victoria Street, London, S.W.1.

We understand that the assets and book debts of the RUNBAKEN MAGNETO CO., LTD., Cheetham, Manchester, have been disposed of to M.A.R.S., Ltd., Ashburton Road, Trafford Park, Manchester.

MESSRS. BLANDFORD & Co., wireless engineers, of Gravesend, have removed to 6, Wrotham Road.

THE PARK ROYAL ENGINEERING CO., LTD., has appointed Messrs. T. Hood & Co., Ltd., 7, St. Stephen's Avenue, Bristol, as its West of England agents for electrical switchgear and instruments.

Catalogues and Lists.—THE "SOLUS" ELECTRICAL CO., 10, Judd Street, W.C.1.—An illustrated and priced pamphlet describing the "Acdic" electrolytic rectifier for battery charging.

THE MARCONIPHONE COMPANY, LTD., of Marconi House, Strand, W.C.2, has issued a showcard (17¼ in. by 11¼ in.) in colour, advertising its broadcast receiving apparatus.

POPE'S ELECTRIC LAMP CO., LTD., 5, Arthur Street, New Oxford Street, W.C.2.—An illustrated folder advertising "Elasta" incandescent lamps of various patterns.

MESSRS. E. HILL-ADAM & Co., LTD., 93, Stamford Street, S.E.1.—A priced catalogue of door hangers and latches, window fittings, lifting tackle, &c., made by the Richards-Wilcox Canadian Co., Ltd.

MESSRS. ADAM HILGER, LTD., 75a, Camden Road, N.W.1.—An exhaustive catalogue of the firm's scientific apparatus. This is divided into 13 sections, with a thumb index, each dealing with instruments for a particular branch of research.

THE JACKSON ELECTRIC STOVE CO., LTD., 143, Sloane Street, S.W.1.—A blotter bearing an illustration of a "Jackson" cooker and a calendar for January. Also List D.C. 22, illustrating and describing the company's "Model 22a" cooker.

SWITCHGEAR & COWANS, LTD., Old Trafford, Manchester.—Descriptive Section No. 1, dealing with three-phase oil-immersed circuit breakers for switchboard mounting, direct or remote control.

MESSRS. J. BLAKEBOROUGH & SONS, LTD., Woodhouse Works, Brighouse, Yorks.—A folder illustrating a number of the company's products, including sluice valves, sluice gates, &c.

THE HART ACCUMULATOR CO., LTD., Stratford, E.15.—A price list of the company's portable accumulators in ebonite containers.

THE ENGLISH ELECTRIC CO., LTD., Queen's House, Kingsway, W.C.2.—Price List 2,111 describing ironclad oil circuit-breaker pillars, and Publication No. 561 dealing with the company's mixed-pressure turbines. Both publications are well illustrated.

MR. G. W. ROBINSON, 39, Great Windmill Street, W.1.—A priced and illustrated pamphlet advertising portable electric fountains.

ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHARLEROI, 56, Victoria Street, S.W.1.—January stock list of motors and dynamos.

MESSRS. FERRANTI, LTD., Hollinwood, Lancs.—Pamphlet WA400, containing a description of the company's intervalve radio transformer with illustration and diagrams.

METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester.—Special Publication No. 7720/3, containing a fully-illustrated description of the winding-engine installation at the Harworth Colliery, Bawtry, Yorks.

MESSRS. HERBERT MORRIS, LTD., Loughborough.—Book 83, containing numerous illustrations of applications of the company's electric overhead cranes.

MESSRS. A. P. LUNDBERG & SONS, 477-489, Liverpool Road, Holloway, N.7.—Publication S.42, describing and illustrating an adjustable two-pin plug adaptor.

MESSRS. JOHNSON & PHILLIPS, LTD., Charlton, S.E.7.—List TTS, illustrating and describing the company's transformer tapping switches.

Unemployment.—There was a very large increase in the number of unemployed persons during the week ended December 29th, the total rising by 103,373 to 1,272,600. This figure was only 13,023 less than the total at the end of 1923.

Book Notices.—"Economics of Iron and Steel." Skelton. Second edition. Pp. vii+679. Fully illustrated. London: Stevens & Sons, Ltd. Price 20s. net.—A work descriptive of the practice in the heavy branches of the iron and steel trades, written non-technically, with an appeal to the engineer and merchant alike. The testing of the various grades of iron and steel is dealt with extensively, making a special appeal to the engineer; while the general conclusions drawn from considerations of the tests and treatment of the material from its raw state to the manufactured article are a practical feature of value to all. The use of electricity in the production of iron and steel articles is dealt with in a short treatise on the methods of electric welding and the production of ferro-alloys by the electric furnace. Interesting comparison is made between the arc welding processes and the more advanced methods, "spot" welding, &c., requiring specially designed machinery.

"Health, Welfare, and Safety." January. Southport: J. Guthrie, Oliver & Co. Price 1s.—This is the first issue of a monthly journal dealing with the three matters named in the title as affecting the textile trades. The section dealing with the correct illumination of factories should be of interest to some of our readers, and in subsequent issues it is proposed to publish articles on smoke abatement. It is claimed in an article on "Improved Lighting" that "for an increased expenditure amounting to 2½ per cent. on your payroll you will increase the output of your mill by 15 per cent."

Scientific Paper No. 492 of the United States Bureau of Standards. "Formulas, Tables, and Curves for Computing the Mutual Inductance of Two Coaxial Circles." (36 pp.) Washington: Government Printing Office. Price 15 cents.

Messrs. Gurney & Jackson, of 33, Paternoster Row, E.C., have been appointed official publishers to the Faraday Society, and in future they will deal with all business relating to the sale of the *Transactions* and separate reports of general discussions.

"The J. & P. Transformer Book, being a Practical Technology of the Power Transformer," by S. A. Stigant and H. M. Lacey. Pp. xi+400; figs. 275. London: Johnson and Phillips. Price 5s.

"Wireless Working Hints for Beginners," by A. Williams. Pp. viii+94; 58 illustrations. London: Percival Marshall and Co. Price 1s. 6d. net.

"Wireless Annual for Amateurs and Experimenters, 1925." Pp. 156+32; illustrated. London: The Wireless Press, Ltd. Price 2s. 6d. net.

The *Transactions* of the South African Institute of Electrical Engineers. October, 1924. Johannesburg: The Institute. Price 2s.—A paper on "Carrier Wave Telephony," by Mr. N. Hilarius, is reproduced in this issue.

"Up-to-date Gramophone Tips," by H. T. Barnett, M.I.E.E. (Pp. vi+76.) London: Gramophone (Publications), Ltd. Price 1s., post free.

"List of Corporate Members and Non-corporate Members." September 30th, 1924. London: The Institute of Transport.

Copper and Lead Prices.—Messrs. F. Smith & Co. report January 13th:—Copper (electrolytic) bars, £72, 5s. decrease; do. do. sheets, no change; do. do. wire rods, £82, 5s. decrease; do. do. h.c. wire, no change.

Messrs. James & Shakespeare report January 14th:—Copper Lake (best selected), sheet and rod, no change; English pig lead, £44 10s., 5s. decrease.

The Export of French Bauxite.—According to a writer in a French newspaper, a campaign is tending to assume shape in the direction of the prohibition of the export of bauxite, and it seems that pressure in this issue is actually being exercised on the Ministry of Commerce. In his opinion such a prohibition would be as unjustified and illogical as any hindrance to the deliveries of iron ore. The bauxite resources are estimated at over 60,000,000 tons, but the French production of aluminium does not exceed 17,000 tons per annum, corresponding to about 140,000 tons of bauxite. If France were to refuse to supply foreign customers with bauxite, the fact would act as a stimulus to them to seek out new deposits, and in this way customers would be diverted from the French market.

New Zealand Water Valve Contract.—MESSRS. J. BLAKEBOROUGH & SONS, LTD., Brighouse, inform us that they have received an order for three Larner-Johnson valves for the Arapuni hydro-electric scheme of the New Zealand Government. Each of these valves is 12 ft. in diameter at the inlet, 9 ft. in diameter at the outlet, and 20 ft. 3 in. long, and weighs approximately 65 tons. The valves are of the needle type, and will control the flow of water to vertical spiral casing Francis turbines. They will be controlled from the main switchboard, or by hand or motor at the valve itself. The opening or closing time will normally be about two minutes, but this can be reduced to 1½ or increased to three minutes. The order was obtained through the main contractors, Sir W. G. Armstrong, Whitworth & Co., Ltd.

Chinese Notes. — Long-distance telephone services between Mukden and Jehol and between Yangchow and Paoying (Kiangsu) were commenced in November.

The Chinese Government Telegraph Administration, 27, Markham Road, Shanghai, is asking for tenders for materials used in its department.

The Canton Electric Co. reports that 1923 was a good year. The number of customers rose to over 24,000.

Swiss Electrical Imports.—In the course of a review of Swiss foreign trade in the first nine months of 1924, the *Board of Trade Journal* points out that imports of dynamo-electric machinery totalled 472 tons, as compared with 633 tons in the equivalent period of 1923. Imports from Great Britain rose from 8 to 153 tons; those from Germany decreased from 547 to 190 tons.

Prospects in Spain.—The F.B.I. Commissioner in Madrid, in concluding a report upon the prospects of Spanish industry, says that it is to be hoped that once the expenditure in connection with the Moroccan campaign is reduced, it will be possible to place the national Budget on a more satisfactory footing. This will be the first step towards facilitating the desire of the Government to devote attention to public works on a large scale; to increase communications by land and water; to encourage agricultural development; to promote associations of groups of industries, and the study of means for producing as cheaply as foreigners, &c.

South African Representatives.—The report of the British Manufacturers' Representatives' Association of South Africa for the year ended November 30th last shows that at that date there were 410 members. The council for 1925 has seven entirely new members. Among the matters dealt with in the report is that of preference. It is stated that the value of the 3 per cent. *ad valorem* rebate has diminished in value as the tariffs have been increased. Industrial development has proceeded rapidly in the past five years—the gross value of the output having increased by over 75 per cent. In that period the number of factories has increased from 4,000 to over 7,000, and these are distributed among over a hundred industries. Another feature of the report is that dealing with the new "British Trade" members, who were formerly elected to honorary membership. Fifty firms have been enrolled in this category. During the year the Association made representations to the Official Committee on Government Purchases, which included a request that an identical date should be fixed for the receipt of tenders both in Great Britain and South Africa, with an allowance of sufficient time for consultation between the Home firms and their representatives. The representations were "favourably received." Other subjects treated in the report are: fraudulent insolvencies; membership of Chambers of Commerce; and the importation of new goods for sale by auction.

The British Industries Fair.—The Birmingham City Council at a meeting last week decided unanimously to give civic recognition of the British Industries Fair. The Lord Mayor of Birmingham (Alderman Bower) in moving a resolution deciding to co-operate with the Birmingham Chamber of Commerce in the organisation of the Fair, and to incur the expenditure necessary to afford such co-operation, pointed out that the future *venue* of the London section might depend on the success obtained. A unique opportunity was presented, he said, to the city of assisting the long-delayed trade revival, for which everybody was waiting and the committee hoped that every effort would be made this year to secure results of lasting benefit to the city and nation.

It is the intention of the Lord Mayor to make an appeal to the country generally for support for the British Industries Fair at Castle Bromwich, in view of its importance to the industrial community. A sub-committee consisting of the trading and other departments of the Corporation has been appointed to assist in the co-ordination of the exhibits to be made by the Corporation. A good display of electrical plant and equipment is promised.

The German Electrical Industry.—According to the reports presented by the Prussian Chambers of Commerce, prices in the electrical industry increased in December, but the hoped-for revival in the course of business was only partly realised. Orders for large installations were only placed in cases where the electricity works or tramways had available liquid funds resulting from the surpluses on working or where they were enjoying favourable tariffs. Business in electrical equipment for main lines of railways and tramways increased, as also did transactions in light, power, and telephone and telegraph cables and insulated wires, both in Germany and for export.

Lead.—In the course of their letter dated January 10th, Messrs. James Forster & Co. report:—"What we said last week with regard to the position of prompt supplies is borne out by the fact that January lead has already been declared to consumers against their contracts. English lead also is on offer for prompt delivery at a small premium over foreign, this being due to heavy arrivals of silver lead from Canada. Consumers have been very little in evidence this week, the market being chiefly a professional one. Supplies meanwhile come in in a steady stream, and should again this month attain about 20,000 tons."

Electricity Supply Workers' Wages.—The Scottish District Council for the Electricity Supply Industry, at a meeting in Glasgow on January 6th, made an award of 4s. per week to skilled men employed in the industry. The new rate for skilled electricians, fitters, blacksmiths, &c., employed in the industry is 1s. 6½d. per hour as from January 1st. The schedule rate for jointers is now 1s. 5.6d., and for plumber-jointers 1s. 6.71d., although in several of the electricity supply undertakings it has been the practice to pay a higher rate than the schedule rate to these men.

Members of the Amalgamated Engineering Union who are employed in electricity supply undertakings in the North-Western Area recently claimed the restoration of the 10 per cent. deduction from their wages made in 1923, as has been done in other districts. The Employers' Side of the District Council for the Electricity Supply Industry has refused the request, and the matter is to come before the National Council to-day (Friday).

Municipal Trading at Burnley.—At a meeting held at Burnley, on January 8th, to consider the promotion of a new Parliamentary Bill, Mr. Smith (for the Burnley Chamber of Trade) objected to the clause authorising the Corporation to sell electrical fittings. The Corporation, as competitors with traders who were ratepayers, would have no need to make a profit. This was not fair competition. The same applied to wholesale contracting. He thought it objectionable for the Corporation to possess powers to contract in opposition to private traders anywhere. If the Corporation was prepared to accept a model clause enabling it to act only through contractors, the Chamber of Trade would then have no objection. Councillor Nuttall, in reply, said that the Corporation was of opinion that it already had the powers covered by the clause to which Mr. Smith objected. One reason for the clause was to make it perfectly clear that the Corporation could exercise these powers, and he thought there was every reason why it should do so. The Gas Department had power to sell its fittings; why not the Electricity Department? He assured Mr. Smith that Corporations were just as eager for profit as private individuals, and Mr. Smith could also be assured that if it obtained the powers in question, the Corporation would not attempt to undercut the private trader. The Corporation hoped to work in co-operation with him. They hoped to show up-to-date appliances and bring more work to local contractors. Councillor Sutcliffe supported the Bill as it stood because he did not think Burnley electrical traders had kept abreast of the times. The clause was approved.

German Electro-Medical Apparatus.—It is stated that the Siemens & Halske Co. and the firm of Reiniger, Gebbert and Schall, of Erlangen, have decided to enter into a community of interests with regard to electro-medical apparatus. The change will mean interchange of experience, combination of works development, and lower costs of production. The S. & H. Co. will take a financial interest in the Erlangen business, and a new company will be formed to sell the electro-medical apparatus of both firms.

Platinum.—Should the reports of the discovery of additional and extensive deposits of platinum in the Lydenburg district of the Transvaal be substantiated, it may be expected that this valuable metal will recover the important technical position which it held before its rising price removed it from the field of industrial use except in a few special cases. At the present moment platinum is nearly six times as expensive as gold, being £25 an ounce, as compared with 87s. 9d. The many peculiar properties of platinum—its high melting point, its great electrical resistance, its power of occluding gases, its catalytic properties, and its very low coefficient of linear expansion—make it a highly important and useful metal to the physicist and chemist and in a variety of manufactures. Its use for such purposes as the leading-in wires in electric lamps and as a catalyst in the manufacture of sulphuric acid from sulphur dioxide and air has diminished of late years on account largely of its scarcity and high cost. At one time Russia was the principal producer of the metal, but under the Republic the output has fallen off and is now closely rivalled by that of Colombia. Increasing quantities are being obtained as by-products in the treatment of copper ore and of the nickel-copper and cobalt-nickel ores of Ontario. A recent writer stated that there was no reason to anticipate the discovery of any new fields likely to add materially to the production of platinum. It will be interesting to observe whether this anticipation is borne out by the subsequent history of the movement now agitating the shares of the companies owning land in the Lydenburg district.—*The Engineer.*

Exhibition of Street Lighting Appliances.—In connection with the second annual meeting of the Institution of Public Lighting Engineers in Leeds on September 14th, 15th and 16th it is intended to hold an exhibition of the latest types of lamps and appliances for street lighting (both gas and electric). Firms willing to exhibit are asked to communicate without delay with Mr. C. S. Shapley (president-elect), engineer and manager, City of Leeds Gas Department, Market Hall, Leeds, as the accommodation is limited.

Committee on Companies Acts.—The President of the Board of Trade has appointed a committee to consider and report what amendments are desirable in the Companies Acts, 1908 to 1917. The Committee is constituted as follows: Mr. Wilfrid Greene, K.C. (chairman), Mr. A. Andrewes-Uthwatt, Hon. R. H. Brand, C.M.G., Mr. Harold Brown, Mr. Archibald H. Campbell, Mr. William Cash, F.C.A., Mr. E. R. Eddison, C.M.G., Sir Edward Manville, Sir James Martin, Mr. W. E. Mortimer, Mr. Arthur Stiebel, and Mr. R. Hugh Tennant. The secretary to the Committee is Mr. W. W. Coombs, M.B.E., Board of Trade, Great George Street, S.W.1, to whom all communications should be addressed.

German Firm Secures Mexican Order.—The Deutz Co., a German firm in Mexico City, has recently received the bulk of an $83,000 contract covering the purchase of the necessary electrical equipment for the Nuevo Laredo water system. *Commerce Reports* states that the order was secured by the offer of very liberal terms, *viz.*, the payment of 15 per cent. with the order, 10 per cent. within one month of the date of the contract, and the balance in monthly instalments of 5 per cent., to commence with the delivery of the material.

Mexican Invoice Regulations.—The *Board of Trade Journal* states that the Mexican Government has decreed that exporters from the United Kingdom must have their commercial invoices attested by a notary public in this country. The value to be entered on the invoices is the value f.o.b. port of shipment. The invoices, together with the third copy of the Consular invoice and postal receipts relating to the other two Consular invoices, are to be sent by registered post to the consignee.

British Industry and Allied Debts.—The intimate relationship between the adjustment of inter-Allied indebtedness and the promotion of a steady revival of trade in this country formed the subject of a timely letter written by Sir E. Manville to *The Times* of January 10th, in which he urged that this matter should be kept steadily in view in the conversations taking place in Paris. He showed that this embarrassing problem was of far more serious consequence to the prosperity of Great Britain and her Dominions than to any of the other Allied or Associated Powers. We quote:—

"From the point of view of British productive enterprise the funding of our debt to the United States has imposed upon the profits of industry a burden of taxation equivalent to 7d. in the £ for 60 years to come. . . . To the plain business mind it would appear reasonable that, before the serious discussion of the future of international indebtedness, the Allied European States should undertake a corresponding responsibility to that which the Government and people of this country have assumed on their behalf."

Sir Edward, continuing, said that the British manufacturer, whose effort provides practically the whole of the resources of the taxable capacity of this country, must always, in considering his costs of production and in organising his competitive power in world markets, take into account this obvious handicap. "Carrying this super-load, the British manufacturer cannot but reflect upon the more advantageous position of his foreign rival. And, further, the charge which the British taxpayer has thus imposed upon him means the withdrawal from the extension of British enterprise for factory improvement and enlargement of plant of a large sum, with its obvious crippling effect in contrast with the freedom of foreign competing producers, who should, to say the least, be placed in a similar position for the settlement of the outstanding debts of their own countries.

"The situation is intensified from the British point of view because of the fact that not merely does the foreign manufacturer enjoy this immunity, but the British taxpayer is actually discharging the obligations undertaken not for himself but for his foreign competitor."

Local Exhibition.—BRADFORD.—A Radio and Electrical Exhibition was held at the Belle Vue Drill Hall, from January 3rd to 10th, under the auspices of the *Yorkshire Evening Argus*. The exhibition was opened by Mr. Eugene Ramsden, M.P. for North Bradford. The hall was tastefully decorated, and music was provided by an orchestra and a loud speaker on the balcony, broadcasting the B.B.C. programmes. A number of local and national firms held stands, and the result was a very representative and comprehensive display.

British Trade Mark Applications. — The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from January 7th. In the case of foreign applications, the names and addresses of the British representatives are also given:—

Weco. No. 452,413. Class 6.—Machinery of all kinds and parts of machinery. Western Electric Co., Ltd.

Gyrector. No. 453,035. Class 8.—Philosophical instruments, scientific instruments, and apparatus for useful purposes. Favorite-Apparatenbau Gesellschaft, 43-44, Joachimstalstrasse, Charlottenburg 2, Germany. (Boult, Wade & Tennant, 112, Hatton Garden, E.C.1.)

Cenco (lettering and design). No. 451,048. Class 8.—Physical, chemical, and scientific apparatus. Central Scientific Co., 460, East Ohio Street, Chicago, U.S.A. (White, Langner, Stevens & Parry, 88-90, Chancery Lane, W.C.2.)

Dakol. No. 451,282. Class 13.—Electric lamps and fittings and accessories therefor, and electric switches. A. R. St. Clair, Waterford Crescent, Whitley Bay, Northumberland.

Numa. No. 450,562. Class 18.—Bell and signalling installations. H. R. Webb & Son, Wharf Road, Grantham.

Patent Restoration.—An order has been made restoring Patent No. 149,687 of 1919, granted to Max Rockstroh, for "Improvements in recording dynamometers."

Our Foreign Trade.—DECEMBER FIGURES.—The following were the values of imports and exports of electrical goods and machinery during December, 1924:—

Imports.	Dec., 1924.	Inc. or dec.	12 months, 1924.
	£	£	£
Electrical goods and apparatus	440,642	+ 206,233	+ 975,029
Machinery	1,032,686	+ 162,614	+1,189,875
Exports.			
Electrical goods and apparatus	911,809	−1,719,502	− 127,277
Machinery	3,848,101	+ 357,752	+ 183,536
Re-exports.			
Electrical goods and apparatus	12,985	+ 872	+ 56,843
Machinery	103,135	+ 20,139	+ 127,691

American Export Co-operation.—*Commerce Reports* states that more than 500 producers, mills, and factories have taken advantage of the provisions of the Export Trade Act (the Webb-Pomerene law) and have formed combinations or associations for the purpose of exporting raw materials and manufactured products from the United States. The Act grants to such combinations immunity from the provisions of the Anti-Trust laws in so far as operations are carried out solely with foreign countries. The outstanding advantage of the scheme is the possibility of pooling administrative expenses, and, in addition, the operating costs are reduced, and a central body can deal with such matters as warehousing and dock facilities, inspection, the adjustment of claims, &c.

An Electric Furnace Demonstration.—AUTOMATIC AND ELECTRIC FURNACES, LTD., has arranged with B.S.A. Tools, Ltd., to give a demonstration at Birmingham of tool-hardening by the use of a Wild-Barfield electromagnetic furnace. The exposition will take place at the Corporation's electrical showrooms, Paradise Street, from January 19th to 24th.

Calendars and Diaries.—The calendar of the MULLARD RADIO VALVE CO., LTD., Balham, S.W., takes the form of a cardboard model of one of the company's valves, on the base of which is a block of daily slips. The place of the filament, grid, &c., is, however, taken by the portrait of a pretty girl—a novel but very effective type of valve.

A calendar received from Mr. PHILIP S. SCHULMAN, Manchester, bears a picture of a fair lady—a favourite calendar subject—by an American artist. The legend, "Beautiful shades in beautiful shades," indicates the nature of the sender's business.

The JOHNSON & MURRELL ELECTRIC CO., LTD., Upper Thames Street, E.C., has sent us a calendar with monthly sheets on each of which appears an illustration of the goods supplied by the company and a small calendar for the year.

MESSRS. W. G. BEAUMONT & SON, painters of bridges, gasholders, and other large structures, Bow, E., have sent us a copy of their "Practical Illustrated Diary" for 1925. This is a quarto volume with a page devoted to each week, with interleaved blotting paper.

The CHLORIDE ELECTRICAL STORAGE CO., LTD., Clifton Junction, Manchester, has issued a neat calendar with monthly date slips and a coloured picture of the "Exide Girl."

Russian Note.—*The Electrical Equipment Market.*—December and the opening days of January, says the *Commercial and Industrial Gazette*, were marked by an increased demand for electro-technical articles, especially on the part of the railways owing to proposed electrification work. Up to the present the market, with very few exceptions, has had its demands fully satisfied. Only in installation material is any shortage felt, the market for this material depending upon importations from America, while all other electrical requirements are well covered by home production. Recently a shortage has been felt of fine wires and certain small porcelain articles. The production of incandescent lamps has improved and the Russian output can now freely compete with the foreign article, with the result that Soviet lamps are now being demanded instead of the foreign ones previously in favour.—*Reuter's Trade Service* (Moscow).

Social Events.—The staff of the Aylesbury Borough Council Electricity Works held its first annual dinner at the Bull's Head Hotel on January 1st. The chair was taken by Mr. Turnbull, electrical engineer, supported by the Deputy Mayor (Alderman Thrasher, J.P.). Alderman Robinson, and Councillors Viscount Stopford, F. Standring, and Waters, and the Works Superintendent, Mr. R. E. Sivesley. A programme of music was interspersed between the toasts. The arrangements were in the hands of Messrs. A. Hailey, H. Moore, P. E. Johnson, and W. H. Streeter, hon. secretary.

On January 7th the staff and representatives of Messrs. Pritchett & Gold and E.P.S. Co., Ltd., and Peto & Radford were entertained by the directors at the Grosvenor Hotel, S.W. The first part of the evening was filled by a very enjoyable concert provided by members of the staff. The chairman, Sir Archibald G. Gold, and Mr. Peto made brief speeches, and, on behalf of the staff, Mr. A. Woodward suitably thanked them. Douglas Day's Orchestra provided music for the ensuing dance.

The profits of a dance arranged by the members of the Metro-Vickers (Sheffield) Sports' Association were devoted to providing a New Year's party for children at the Cutlers' Hall, Sheffield, on the 3rd inst. The works manager, Mr. G. H. Nelson, and the members of the various office staffs, acted as "waiters."

Encouraging Danish Electrical Exports. — Electrical machinery and apparatus are included in the list of goods the export of which is being encouraged by the Danish Government by means of financial assistance to exporters in the form of a guarantee of their drafts up to 85 per cent. of their face value.

Radio Exhibition at Prague.—Preparations are being made for the holding of a Radio Exhibition in connection with the Spring Fair to be held in Prague from March 22nd to 29th next. Further particulars can be obtained by intending exhibitors on application to the management of the Prague Fair, Staronestska, Radnice, Prague I.

For Sale.—Stoke-on-Trent Corporation Electricity Department has for disposal a 600-kW Ferranti single-phase alternator and engine. Messrs. Hopps & Bankart, of Loughborough, invite offers for two Tangye suction-gas engines and one Tangye suction-gas producer, now lying at the premises of Messrs. F. Caldwell & Co., Ltd., Loughborough. By direction of the George Cohen & Armstrong Disposal Corporation, Messrs. Fuller, Horsey, Sons & Cassell, will sell by auction on February 11th and following days, at the County Hall, Carlisle, the remainder of the plant, machinery stores, electrical plant, &c., of H.M. Factory, Gretna. By order of the Lords Commissioners of the Admiralty, Messrs. Fuller, Horsey, Sons & Cassell, will sell by auction at the Admiralty Depôt, White Lund, Lancaster, on February 3rd, surplus plant and machinery, including electrical plant, &c. (See our advertisement pages to-day.)

Fire.—On January 10th a fire occurred at the Peel-Conner Telephone Works, Coventry. The outbreak was in the enamelling and lacquering shop, and it was confined to that department by the special construction of the building. The only damage done to the surrounding departments was caused by water.

Trade Marks in Turkey.—The Turkish Ministry of Commerce has recently issued a notice that the patents and trade marks registered with the Constantinople Government after March 16th, 1920, have been declared non-existent by the National Government at Angora and that, consequently, in order to secure their validity they must be re-registered.

Swedish Engineering Dispute Settled.—The labour dispute in the engineering industry has now been definitely settled and a new agreement was signed on January 9th. The new agreement is valid for one year, and in all essentials is identical with the previous one.—*Reuter's Trade Service* (Stockholm).

The Census of Production.—It is hoped by the Board of Trade that the forms of census will be issued by the end of February when three months will be allowed for completing and returning them.

Lighting and Power Notes.

Australia.—SYDNEY ELECTRICITY SUPPLY.—According to *The Times Trade and Engineering Supplement*, the Sydney City Council is considering a proposal to erect a power house for the generation of electricity on a large scale on the ocean front near a coalfield on the South Coast. The sites at Ultimo and Pyrmont have been fully developed, and it is not proposed to make further extensions at these places. The White Bay site of the Railway Commissioners is suitable for development to a point at which it could be relied on for an addition of 120,000 h.p. It is estimated that the extension of the power house at White Bay will provide the additional supplies of electricity required in the metropolitan area until 1929 or 1930. For the additional supplies required after that date a new source must be found. It is the view of the technical officers of the Railway Department and the City Council that it is advisable to proceed immediately with the selection, acquisition, and equipment of a site for a power house on a very large scale, on or as near as practicable to a coalfield. It is agreed that the site must be on the ocean or an inlet of the ocean, and near enough to Sydney to make the transmission of the electricity from the power house to that city commercially practicable.

Basingstoke. — ELECTRICITY EXTENSIONS. — The Town Council is to dispose of set No. 3 at the electricity works and install in its place a Diesel engine direct coupled to a 410-kW generator, in connection with the supply to Messrs. Thornycroft & Co., and application is to be made for sanction to a loan of £10,500 to carry out the scheme.

Battle.—SPECIAL ORDER.—The Southern Counties Electric Light and Power Supply, Ltd., has applied for a Special Order to supply electricity in the urban district.

Bedford.—YEAR'S WORKING.—The report of the borough electrical engineer (Mr. E. W. L. Phillips) for the year ended March 31st last shows that the revenue of the electricity undertaking amounted to £63,804, as compared with

£60,440 in 1922-23. Against this was charged a working expenditure of £34,008, as against £35,727, leaving a gross profit of £29,796 (£24,713). The final result was a profit of £7,414, as compared with £2,101 in the preceding year, of which £1,300 was contributed to the borough fund. During the year £6,549 was spent on capital account, the total expenditure being £321,550. The sales of electrical energy increased from 4,664,225 to 5,805,954 kWh, and the maximum supply demanded rose from 2,840 to 3,140 kW.

Birkenhead.—LOANS.—The Corporation is applying for sanction to the following loans:—£27,000, mains and services; £8,000, h.p. feeders; £4,000, transformers, &c.; £682, King's Lane sub-station.

Bridgend.—YEAR'S WORKING.—The report on the working of the Urban District Council's electricity undertaking (engineer: Mr. W. Wellbury) for the year ended March 31st last records a total revenue of £13,208, as compared with £13,490 in the preceding year. Working expenses amounted to £8,530, as against £8,816, leaving a gross profit of £4,678 (£4,673), to which was added a balance from the last account of £9,097, making a total of £13,775. After deducting capital charges, and contributing £500 to the relief of the rates, a net balance of £10,043 was carried forward to the next account. The sales of electrical energy increased from 654,165 to 755,491 kWh, and the maximum supply demanded from 470 to 580 kW.

Bristol.—LOANS.—The Town Council is applying for sanction to the borrowing of £46,000 for house services and £50,000 for e.h.p. sub-stations and feeder cables to cover the estimated requirements for the next three years.

Blackpool.—PARLIAMENTARY BILL.—At a recent meeting of the Corporation proposals to include the following clauses in the new Parliamentary Bill were rejected:—(1) The fitting up of showrooms and offices in connection with the electricity undertaking; (2) the construction of a tramway near Bispham station crossing.

HIRE OF DOMESTIC APPLIANCES.—The Corporation has set aside a sum of £2,000 from the electricity reserve fund for the purchase of domestic appliance to be let on hire.

Canada.—HYDRO-ELECTRIC DEVELOPMENT.—During the past year new capital invested in hydro-electric enterprises in Canada totalled approximately $45,000,000. The Province of Quebec added about 175,000 h.p. and Ontario about 133,000 h.p. The total installation in Canada is now 3,569,000 h.p.—*Reuter* (Ottawa).

Chesterfield.—LOAN SANCTIONED, &C.—The Corporation has received sanction to borrow £23,100 for mains, services, meters, and switchgear. The borough electrical engineer (Mr. D. H. Davies) has been asked to report upon the requirements of plant to meet the next winter's load; the advertising of electricity for heating and domestic purposes; the synchronisation of privately-owned electric clocks; and the advisability of establishing a showroom and the hiring-out of electric cookers.

Continental.—FRANCE.—The surveys for a scheme of rural electrification throughout the Lower Pyrenees have been ordered. In the Upper Pyrenees, as forming the first stage of a general scheme, the Conseil Général of that department has entrusted the electrification of a district to the north of Tarbes to the Société Force et Lumière des Pyrénées, subject to consultation with the municipalities interested.

SWITZERLAND.—It is proposed to extend the plant of the municipal electricity station at Mollis (Canton of Glarus). During the past year, owing to the increased demand, a supply of electricity was purchased from the North-East Swiss power station.

Dalton-in-Furness.—ELECTRICITY SUPPLY.—The Urban District Council, after a private conference with Mr. Burnett, the borough electrical engineer of Barrow-in-Furness, accepted the Barrow Corporation's terms for a proposed supply of electricity to Dalton, and eventually also for the out-districts of Lindal and Askam, and confirmed its consent to the Barrow Corporation's application for a Special Order.

Daventry.—ELECTRICITY SUPPLY.—The Northampton Electric Light and Power Co. has received instructions from the British Broadcasting Co. to lay a cable to Borough Hill to supply the new wireless station being erected there.

Gloucester.—PROPOSED BULK SUPPLY.—The Corporation has instructed the electrical engineer to re-open negotiations with the West Gloucester Power Co., with a view to obtaining a bulk supply of electricity. Previous negotiations have broken down owing to the high charges proposed by the company.

Guildford.—NEW POWER STATION.—In connection with the Town Council's decision to erect a new power station at an estimated cost of £140,000, it is reported that the plant will include two turbo-generators of 1,500 kW each, and one set of 3,000 kW. The two smaller sets will be installed at first and the larger set as soon as the demand calls for it. The steam-raising plant will include four boilers equipped with mechanical stokers, mechanical coal-handling plant, economisers, &c.

Hastings.—ELECTRICITY SUPPLY.—The Town Council has applied to the Electricity Commissioners for a Special Order to supply electricity outside the borough. Mains extensions are to be made in the Clive Vale and other districts at an estimated cost of £1,157, and the switchboard at the new generating station is to be enlarged at an estimated outlay of £1,723.

India.—ALLAHABAD.—The Madras Government contemplates the erection of a power station at Vayitri to supply electricity to the planting area on the Wynaad Hills. The officer deputed to examine the possibilities of the scheme has suggested the construction of converging waterways and an artificial waterfall. The estimated outlay is 60 lakhs.—*Daily Telegraph.*

Knaresborough.—LOAN.—The Urban District Council is applying for sanction to the borrowing of a further sum of £6,000, in addition to £6,891 already sanctioned, in connection with the electricity undertaking.

Leicester.—ELECTRICITY SUPPLY.—In a report recently submitted to the City Council, the Electricity Committee states that the new central electricity station will, at an early date, be capable of taking over the load of the Lero station, and the latter may therefore be closed, when it will become necessary to dismantle the plant and possibly a portion of the buildings.

Lincoln.—DOMESTIC SUPPLY, &C.—The City Council has decided to supply electricity to houses exclusively using it for lighting, heating, and cooking at a flat rate of 1½d. per kWh. Application has been made for a loan of £25,000 for extending the supply of electricity to houses at St. Giles' and for improving the supply to the outlying districts.

Lichfield.—ELECTRICITY ORDER.—The Rural District Council has consented to the application of the City Council for an order to supply electricity within the rural area, the Corporation having guaranteed, under certain conditions, to extend the supply from the Barracks to Whittington village and to Shenstone, the charge for electricity to these parishes not to exceed those in force in the city.

Morecambe.—BREAKDOWN.—During the New Year's week-end storm the town was invaded by the sea, and houses and shops were flooded. Eventually the water affected the electricity mains and cut off the supply in the west and east ends of the town.

Nantwich.—ELECTRICITY IN BULK.—The Urban District Council has asked the Crewe Corporation to consider the question of submitting schemes for a supply of electricity in bulk. Mr. Price F. White, electrical engineer at Bangor, has been asked to act as consulting engineer to the Council in the matter.

Northern Ireland.—BELFAST.—A review of the Corporation's electricity supply for the year just closed shows a considerable advance in the demand for electricity. The Harbour power station completed its first year's working on September 30th, and the results have proved highly satisfactory. The extension to the station, consisting of a second 12,500-kW turbo-alternator, complete with auxiliaries, will be in service in a few weeks' time. The growth of the demand necessitated the commencement of the second stage of the project, and practically the whole scheme is now completed. During the year a considerable number of contracts were concluded with large power users, in addition to a contract with the Belfast Harbour Board for its whole supply, and also with the Imperial Government for the new Houses of Parliament at Stormount. Owing to the depression in the shipbuilding industry, the consumption of electricity by the shipyards decreased considerably, but in spite of this the maximum load this winter reached 21,500 kW, as compared with 20,700 kW last winter. The accounts for the year ended March 31st last showed a gross profit of £176,759, and after providing £101,534 for loan charges, £3,505 for interest, and £2,226 for registration charges, stamp duty in respect of Corporation stock, &c., there remained a net surplus of £69,493. Reductions were made in the charges for lighting during the year, and further reductions have been made to power consumers, &c., as from January 1st.

Peterborough.—LOAN.—The Corporation is to apply for sanction to borrow the sum of £10,000 for mains.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

YORK.—Lighting: Flat rate from 5½d. to 4½d. per kWh. Power: Maximum demand and rateable value systems, a reduction of approximately 10 per cent.

BATLEY.—Following reductions made in October in the charges for lighting and power, reductions in the meter rents have now been made.

STALYBRIDGE.—*The Stalybridge, Hyde, Mossley, and Dukinfield Tramways and Electricity Board.*—Ordinary lighting: A reduction of ½d. per kWh. Cotton mill lighting: A reduction of ½d. per kWh. Power: A reduction of approximately 5 per cent.

Sheffield.—ELECTRICITY IN NEW HOUSES.—Of the 3,526 houses erected by the Corporation, all but 300 are wired for electric light.

(*Continued on page 108.*)

Automatic Telephony at York.

A Large New Strowger Exchange.

On Saturday, November 15th, 1924, there was placed in service in the City of York a new Strowger automatic telephone exchange, which had been manufactured and installed for the Post Office by the Automatic Telephone Manufacturing Co., Ltd., to displace the old magneto and central-battery exchanges which previously ministered to the telephone needs of the City; there now remain only the trunk switchboard and certain outlying sub-exchanges which will still require the services of operators to complete and take down connections.

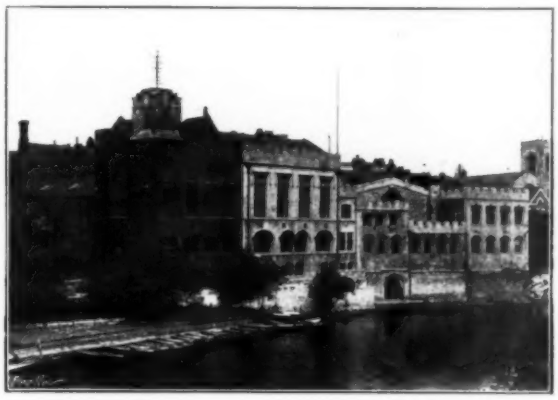


Fig. 1.—Head Post Office Building and Guildhall adjoining.

The main Post Office building adjoins the Guildhall, and houses the new Strowger exchange, in addition to the new manual trunk switchboard. The automatic equipment has a present capacity of 1,700 lines, with facilities for extension to an ultimate capacity of 2,100 lines, which gives the inhabitants of York one telephone to every 50 persons, or a telephone density of approximately 20 per thousand, which is a little below the 1924 average throughout Great Britain.

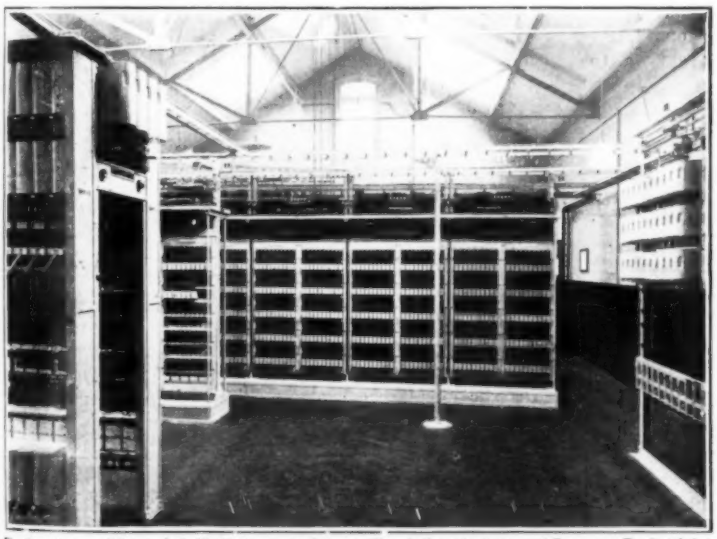


Fig. 2.—Rotary Line-switch Units (centre), Selector Trunk Boards (left) and Repeater Rack (right).

The system in York is the four-digit one, employing primary rotary line switches with final selectors mounted on the back of the line-switch units. The automatic exchange is on the ground floor, and the line-switch units are disposed in three parallel rows of five units each, and a fourth row comprising two units only. The line switches are mounted on shelves, each of which accommodates 10 switches, and the shelves in groups of five are mounted on gates (two per unit) which may be swung out from the centre when necessary, allowing easy access to all cabling. Above the line-switch gates is a fuse panel with alarm fuses, through which current is supplied to each section of line switches and signals of the unit. There is also mounted on the line-switch side a terminal assembly where the outgoing primary trunks and the incoming final selector trunks terminate. Mounted on the reverse side of each line-switch unit are two shelves, each having a capacity for eight final selectors. The banks of all the final selectors are multipled together, allowing any switch access to any of the lines terminating on the banks. At the left of each shelf is an individual fuse panel fitted with alarm fuses through which current is fed to the final selectors. At the top of each line-switch unit is mounted a line intermediate distributing frame, where the incoming line and meter cables terminate; on this frame the final selector banks are jumpered to the line switches. There is also a supervisory lamp strip supporting five signal lamps which indicate by their colour the particular signal with which they are associated, *e.g.*, fuse alarm—red; release signal—green, &c.

The group selectors are mounted separately on selector trunk boards, of which there are two in the York installation. The design of these boards embodies improvements; the selector rack is a substantial steel structure with accommodation for 240 switches, arranged in two bays of 120 switches per bay, 20 switches being mounted on each of six shelves. The shelves are completely self-contained, and can be added to

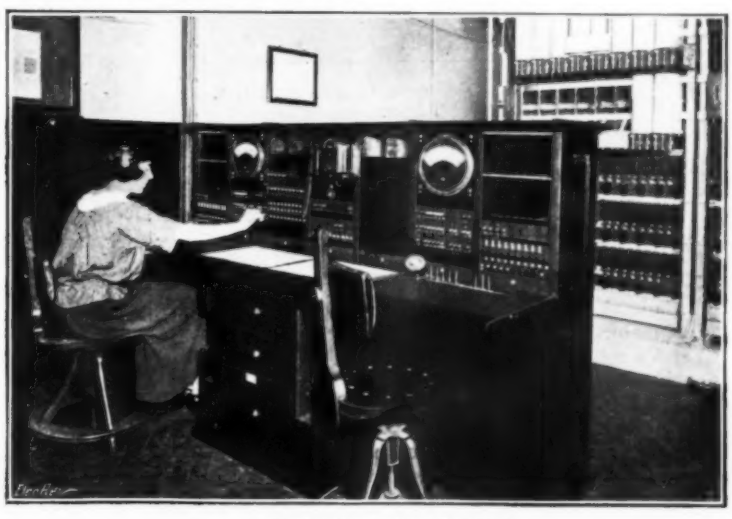


Fig. 3.—Two-position Test Desk.

the rack as and when required. The selectors are of the standard Strowger type with detachable protecting covers over the relays and mechanisms. Switch jacks on the shelves permit the addition of switches to provide for an increase of traffic, or removal for testing purposes. The terminal assembly to which the switch banks are wired provides ample facilities for the "grading" of switch groups.

The remaining equipment of the York switchroom comprises a two-bay repeater rack carrying the necessary repeaters, repeating coils, and condensers; a main distributing frame, consisting of 16 verticals; one end position unequipped at present; a link distributing frame; and a three-bay meter rack equipped with standard telephone meters for registering effective calls only, which is a special feature of Strowger automatic working that eliminates error in recording calls and reduces subscribers' complaints of overcharging. There is also a fully equipped 2-position test desk.

The power plant and batteries for operating the exchange are located in the basement immediately below the switchroom. The power board consists of three enamelled slate panels, mounted on an iron framework, and carries the necessary apparatus for controlling the charging, discharging, ringing, and signalling circuits. On the left-hand panel are mounted the starters and switches for controlling the ringing machines. The central panel carries the

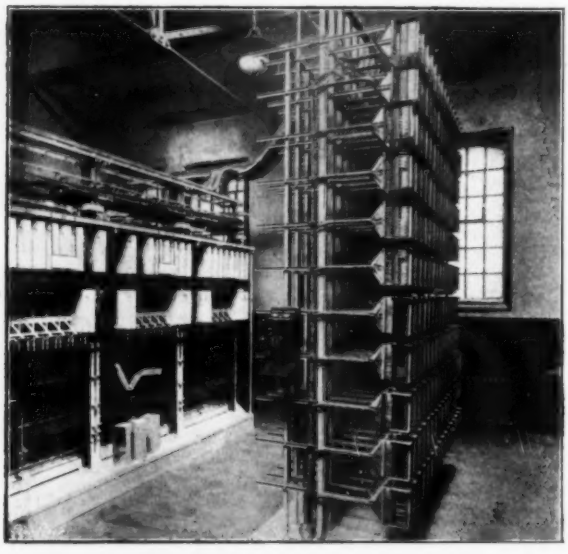


Fig. 4.—Main Distributing Frame and Part of Final Selector side of Rotary Line-switch Units.

ammeter and voltmeter with their respective multipoint switches, enabling readings to be taken at various points on the circuit; the generator field rheostat; booster battery variable charging resistance; s.p. circuit breaker and the switches controlling the charge and discharge of the main and booster batteries. The third and right-hand panel carries the supervisory equipment, and, in addition, a separate starting panel for the charging motor-generator comprises a d.p. main fuse switch and a motor-starting switch.

The main batteries are in duplicate, and comprise two sets of 25 Chloride S.B.W. 9-element cells in lead-lined boxes. Each battery has a present capacity of 486 ampere-hours when discharged at the nine-hour rate, but the boxes will accommodate sufficient extra plates for a discharge of 702 ampere-hours to provide for future extensions, and the extra space is at present occupied by lead displacement tanks. The batteries are supported on single-tier racks and a 125-ampere enclosed type fuse is inserted in the negative lead of each main battery. The booster battery is mounted on a two-tier stand.

The charging motor-generator comprises an enclosed

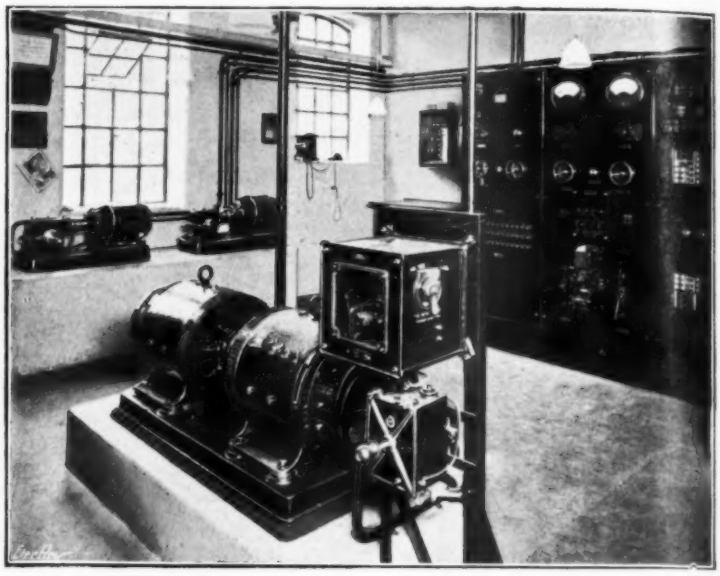


Fig. 5.—Power Switchboard, Charging Motor Generator, and Ringing Dynamotors.

ventilated shunt-wound motor, designed for operating at 460 volts d.c., coupled direct to and mounted on the same bedplate as a shunt-wound dynamo having an output of 100 amperes at 57 volts; the normal speed is 1,000 r.p.m., and the voltage regulation ranges from 50 to 68 volts.

The ringing dynamotors are in duplicate, one being designed to run off the supply mains and the other off the exchange battery in series with an impedance coil.

For all local calls between subscribers directly connected to the York automatic exchange subscribers will dial numbers consisting of four digits. York subscribers also have access to three local sub-exchanges which are respectively called by dialling a single digit in each case, *i.e.*, "6" for Dringhouse, "7" for Fulford, and "8" for Haxby, which immediately secures connection with the manual operator, who is then given instructions for completing the call in the usual way. Conversely, the operators at the three sub-exchanges

Fig. 6.—Battery Room: Booster Battery on left.

have "dialling-in" positions for completing calls incoming to York automatic subscribers.

To call any subscriber in an area outside York, the York subscribers will dial "O," thereby securing the services of the trunk or junction operator at the York manual switchboard, who will complete the call. Other

special service numbers are:—Phonograms and telephone telegrams, dial 90; inquiries, dial 91; official p.b.x., dial 92; and test desk, dial 99.

With a view to improving the inward service from outside exchanges, arrangements have been made whereby the operators at most of the exchanges which have direct lines to York can set up connections direct to York subscribers as well as to other subscribers in the York local area by direct dialling and without the intervention of a York operator. Among the exchanges to be thus fitted with "dialling-in" positions are those at Leeds, Hull, Scarborough, Selby, and Northallerton.

The new manual trunk and junction switchboard at York was also manufactured and installed for the Post Office by the Automatic Telephone Manufacturing Co. It comprises five 2-panel sections, a 4-panel multiple, and a cable-turning section. There are four "A" operators' positions and an inquiry position, each equipped with 14 cord circuits, and "dialling-in" facilities. On this board terminate the various junctions from York to other outlying exchanges, whilst the multiple also allows access to all York auto-subscribers for incoming calls which require the services of an operator to complete them.

The coin-box circuits also terminate on this switchboard, and in this connection it is of interest to record that multi-coin prepayment boxes are to be installed at all existing call offices and at the new telephone kiosks which are about to be erected in various parts of the city. Callers will be able to obtain local calls by dialling, without attracting the attention of an operator, but the connection for speaking will not be "through" until the coins have been deposited. The coin boxes are provided with three slots for the reception of pennies, sixpences, and shillings, respectively. For junction and trunk calls the caller will dial "O" and secure the attention of an operator; on passing particulars of the call, the caller will be advised of the fee; on the call maturing, the caller will be asked by the operator to deposit the necessary coins in the usual way.

The new manual equipment for the York exchange also includes the usual i.d.f., special apparatus rack, and a one-position supervisor's desk.

York is the latest of 25 public exchanges in Great Britain to be equipped for automatic operation, and embodies all the latest Strowger principles.

Bird's-Eye Views of Power Stations.

Hitherto the architect and engineer have been mainly dependent upon drawings, and views from the ground level, for the purpose of visualising their work as a completed whole and studying the composition of a structure in its entirety, and have been unable to gain the information and inspiration that may be derived from a comprehensive survey of the relation of the parts to one another. Nowadays, this disability no longer exists, thanks to the development of the aeroplane, and we give herewith some examples of power stations as they appear when seen from the air.

The diversity of design to be observed indicates the fluidity of power-station practice. At Lot's Road, a comparatively old station, the boiler house and engine room are parallel, whilst at Barking they are at right angles; yet at Tees-side the parallel arrangement is reverted to. Similarly the use of tall brick stacks alternates with that of short steel chimneys. The Stonebridge Park station is the only one of the four which has not the advantage of standing on the bank of a river, and therefore is provided with cooling towers and a large cooling pond; this station, being the property of the L.M. & S. Railway, adjoins a large car shed.

Fig. 1.—Lot's Road Power Station of the London Underground Railways; 100,000 kW.

Fig. 2.—Barking Station of the County of London Co., under construction; 100,000 kW.

Fig. 3.—Stonebridge Park Power Station and Car Sheds of the L.M. & S. Railway Co.; 20,000 kW.

Fig. 4.—North Tees Power Station of the Newcastle-on-Tyne Electric Supply Co.; 40,000 kW.

Hydro-Electric Development in Alberta.

The Calgary Power Company's Undertaking.

THE Calgary Power Co., Ltd., operates two hydro-electric plants of an aggregate capacity of 31,000 h.p. on the Bow river, at points about 50 miles from the city. The first plant was constructed at Kananaskis Falls in 1912 (fig. 1), the Falls being only about 15 ft. high, but by means of a massive concrete dam, 55 ft. high and 775 ft. long, the river level was raised so as to make a total fall of 70 ft. available. For two and a half miles above the dam what were once continuous rapids have been changed to a pond 120 acres in extent.

Fig. 1.—Kananaskis Power Development, Alberta.

The dam has 29 openings through which the flood waters of the river can be passed, and the capacity of these sluices is sufficient to discharge a flood more than twice the size of a great flood which occurred in 1897, when much damage was done in Calgary. An inspection tunnel passes under the dam from end to end.

A concrete-lined canal 650 ft. long conveys the water from the south end of the dam to the gate-house, where screens intercept drift-wood and ice which might otherwise damage the machinery. Two tunnels lead the water from the gate-house down to the turbines.

There are two turbines of the single-runner vertical-shaft type, each of 6,000 h.p. capacity, generating three-phase, 60-cycle current at 12,000 V, when running at 1,645 r.p.m. The overall efficiency is approximately 80 per cent. The power generated at this station is transmitted at generator voltage to the other plant at Horseshoe Falls (fig. 2), about two miles lower down the river.

In general, the design of the Horseshoe Falls plant is similar to that of the Kananaskis plant. There are four generating sets in all, two of 6,000 h.p., and two of 3,500 h.p., a total of 19,000 h.p.

The two larger turbines are of the double-runner, horizontal-shaft type, running at 225 r.p.m., under a 70-ft. head, while the two smaller ones are similar, except for the speed which is 300 r.p.m. The generator characteristics are the same as those of the machines at Kananaskis Falls.

From the Horseshoe Falls the power from both stations is transmitted at 55,000 V to Calgary and Cochrane, and to a plant of the Canada Cement Co., at Exshaw.

The company operates two 55,000-V transmission lines to Calgary, and has a third one under construction. There is a storage reservoir at Lake Minnewanka, belonging to the company, which serves a double purpose—its primary function is to conserve the summer floods for use during the season of low water, but it also reduces the flood flow of the Bow river at Calgary, and so lessens the damage to property along the banks during the flood season.

The city of Calgary has a steam plant of about 13,000 kW; this serves as an auxiliary to the supply obtained from the Calgary Power Co.

The latest available statistics relating to the water-power resources of Alberta give an estimated total of 475,281 h.p. at minimum flow or a dependable six-month supply equivalent to 1,137,505 h.p. The total turbine installation is stated to be 33,067 h.p. This is practically all accounted for by the plant described above. The population of the province is approximately 634,200; and accordingly the hydro-electric power developed is equivalent to about 52 h.p. per 1,000 of population.

At a recent meeting of representatives of Alberta municipalities, a speaker stated that the natural resources of the Province had scarcely been touched. He urged the production of cheap power by the use of these resources, thus opening up further industries.

Fig. 2.—Horseshoe Falls Power Development, Alberta.

Lighting and Power Notes.

(*Continued from page 98.*)

South-East Lancashire.—ELECTRICITY ADVISORY BOARD.—The following items have been extracted from reports of the Board's proceedings:—

Bulk Supplies.—The Manchester Corporation has concluded bulk supply agreements with the Salford and Middleton Corporations. The former contract provides for a maximum demand of 5,000 kW, but the amount of the supply to Middleton is not specified. The power is to be transmitted at 33,000 V in both cases.

Stockport.—The Board has approved of the extension of the Stockport Corporation's power station by the installation of two 10,000-kW turbo-alternators, steam plant, &c., at a cost of £170,000. It is proposed to carry out the work in two stages.

Financially-assisted Schemes.—From correspondence between the Board and the Electricity Commissioners it would appear that the Commissioners would not rule out as ineligible for financial assistance any scheme including a large amount of l.p. distribution work, if the scheme also provides for a transmission line as required by the Act of 1919.

Bury.—The Corporation recently submitted a scheme for a supply to the Jericho district at a cost of £3,707, principally for cables.

Milnrow.—A similar scheme for certain extensions in its area, costing £3,320, was submitted by the Milnrow Urban District Council.

Turton.—The Turton Urban District Council also presented a number of schemes estimated to cost £15,900.

Leigh.—The Corporation recently notified the Board that it was unable to accept the terms of the Lancashire Electric Power Co. for a bulk supply. The Engineering Advisory Committee was asked to consider the matter in consultation with the two parties concerned. In the meantime the L. E. P. Co. was asked to furnish a bulk supply as from January 1st at a price to be determined by the Engineering Advisory Committee. The South Lancashire Tramways Co. had offered to supply energy at a lower rate, but it was necessary first to receive the sanction of the L. E. P. Co., but this was withheld.

Oldham.—The Board has approved a new electricity station at Chadderton for Oldham Corporation.

Southport.—LOAN.—The Electricity Committee has recommended that application be made for sanction to a loan of £39,682 for mains, services, h.p. feeders, transformers, and a sub-station.

Stainforth (Yorks.).—ELECTRICITY SUPPLY.—The local Council has completed arrangements with the Electrical Distribution of Yorkshire, Ltd., for the installation of electric street lighting throughout the district, and cables are now being laid. The lighting will be by 100-watt lamps, the charge to the Council being £3 12s. per lamp per annum for 1,500 hours' use. The installation is expected to be complete by the end of January, and current will then be available for private lighting also at 7d. per kWh through ordinary meter and 7½d. through slot meter, with a probable alternative charge of 12s. per lamp per year and 2d. per kWh consumed.

Tredegar. — ELECTRICITY SUPPLY. — The Urban District Council has engaged Mr. Arthur Ellis to prepare a scheme for the supply of electricity for the town. It is proposed to take a supply of electricity in bulk, and with this object in view the Tredegar Co., the Powell Duffryn Co., the Ebbw Vale Co., and the South Wales Power Distribution Co. have been approached.

United States.—HYDRO-ELECTRIC DEVELOPMENT.—According to the New York correspondent of *The Times*, in connection with the proposed electrification of the Pennsylvania Railroad Co.'s lines between New York and Washington at a cost of $50,000,000, hydro-electric power plant is to be erected near Conowingo Bridge, Maryland. A licence to erect the plant and dam the Susquehanna River has been issued to the Susquehanna Power Co. of Maryland and the Susquehanna Water Power Co. of Pennsylvania by the Federal Power Commission. Electricity generated by this plant will be used not only by the railway, but by the Philadelphia Electric Co., which supplies electricity to the city and county of Philadelphia. The surplus will be sold to companies serving the eastern counties of Maryland and the towns of Southern New Jersey. It is expected that the work will be completed in 1928. The initial power of the plant will be 280,000 h.p., developing later to a maximum of 480,000 h.p., but it is intended to add dams as occasion arises which will bring the total power to more than 1,000,000 h.p. Eventually the Susquehanna plant will be a link in the eastern super-power system, which will include the Niagara Falls, Muscle Shoals, Conghiogheny River, and other existing large and small plants, and to these may be added ultimately the power plant of the St. Lawrence River.

Walton-le-Dale.—ELECTRICITY SUPPLY.—At a meeting of the Urban District Council recently reference was made to the application being made by the Lancashire Electric Power Co. for powers to supply electricity in the area. Objection was taken to the proposal on the ground that the Council did not wish to deal with the company, but with the Preston Corporation direct. In view of this, the Council is considering the desirability of applying for an Order.

Warrington.—FIRE.—The town's electricity supply was threatened on January 1st by a fire which originated in the stores department at the Corporation electricity works, Howley. Owing to the strong wind, there was danger of the flames spreading to the adjacent power station. The local fire brigade, however, eventually subdued the flames. The damage is estimated at several thousand pounds.

Wimbledon.—NEW PLANT.—The Electricity Committee has recommended an expenditure of £1,750 for l.p. and h.p. switchgear equipment to replace the existing switch-fuse-gear in seven sub-stations.

Worcester.—SPECIAL ORDER.—The Electricity Commissioners have submitted to the Ministry of Transport for confirmation an Order made by them authorising the Worcester City Council to supply electricity in parts of the rural districts of Droitwich, Martley, Upton-on-Severn, and Pershore.

Tramway and Railway Notes.

Continental.—FRANCE.—At an extraordinary meeting, the Conseil Général of the Lower Pyrenees has decided that the whole of the tramway network from Pau to Oleron and Monein shall be electrified, at an estimated cost of 12,794,300 fr.

ITALY.—The tunnel which was constructed under Naples for the Direttissima (the direct railway line between Naples and Rome) will be used for a local underground service, and will unite the suburb of Fuorigrotta with the Central railway station, and there will be three intermediate stations, two of which will be served by escalators like those in use in London. Everything is now ready excepting the rolling stock, which is expected soon, and probably the service will be inaugurated early in the spring. The construction of the direct main line between Naples and Rome has been temporarily stopped in view of the great expense involved.—*Daily Mail.*

Darwen.—NEW CARS.—The Corporation is making experiments with new covered tramcars which can safely negotiate the bridges on the route between Blackburn and Darwen. Hitherto passengers have complained that only the open cars have been used on this route, with the result that the Darwen and Blackburn Corporations have had a special car designed which will meet the difficulty. These cars are to be put into commission by the two Corporations within the course of the next few days.

India.—CALCUTTA.—According to *Indian Engineering*, the Works Committee of the Calcutta Improvement Trust has approved the draft agreement to be executed by the Improvement Trust and the Calcutta Tramways Co. in connection with the proposed tramway between the Main Sewer Road from Russa Road to Ballygunge station. The agreement provides that the company will, at its own cost, complete the tramway extension, at an estimated cost of Rs. 4,99,639, the new track to be open within 12 months of the signing of the agreement. By the agreement, the Trust is prepared to pay to the Tramways Company every year by way of subsidy interest at the rate of 7 per cent. on the actual capital expenditure, plus 10 per cent. thereof for supervision and establishment, &c., and to pay the actual working expenses, less the amount of all receipts from traffic on the extension.

London.—METROPOLITAN RAILWAY EXTENSION.—*The Times* reports that the Metropolitan Railway is now carrying out a scheme for doubling the Inner Circle line between Euston Square and King's Cross stations. From King's Cross to Moorgate there is already a double line, and the extension now being carried out will make it possible, if it is necessary, to run fast trains from Euston Square station to Moorgate during the busy hours of the day. At present the second line from King's Cross to Moorgate is used by steam trains only, but the electrification of the line will be completed by the time the new section can be brought into use. For the new lines between Euston Square and King's Cross stations use is being made of a tunnel constructed 60 years ago and approximately 400 yards in length. A considerable part of the tunnel will have to be removed and 700 ft. of new tunnel constructed. A large amount of the work has to be done by means of excavations on the cut and cover system, the tunnel being roofed over and heavy steel girders being used to support the road above and neighbouring buildings. The tunnel will pass under Euston Road, and workmen are at present engaged upon the portion of that road near St. Pancras goods station.

Manchester.—TRAMWAY IMPROVEMENTS.—The Corporation is to put into service 70 new tramcars of the vestibule bogey type, and a number of the old cars are to be discarded. The increase in rolling stock will necessitate additional car accommodation, and it is proposed to erect a new depôt at Birchfields Road to house 250 vehicles. The tramway system was extended by 8¼ miles last year, and an additional eight miles is to be added in a few months. The system will be augmented by 16 more motor vehicles.

Mexico. — RAILWAY ELECTRIFICATION. — The electrified Orizaba-Maltrata section of the Mexico City-Vera Cruz line was recently put into service. The section is 48 km. in length and descends 4,500 ft. in this distance. *Commerce Reports* states that, although the company is owned by British capitalists, the electric locomotives and generating plant were supplied by American firms. Power is supplied from a hydro-electric plant at Tuxpango.

Nottingham.—NEW CAR DEPOT.—The Tramways and Estates Committees have recommended to the City Council that a site comprising 11,257 sq. yards in Cartergate area be utilised as a central tramcar depôt, and the Tramways Committee proposes to transfer from its reserve fund to the Cartergate area account the sum of £28,142, representing the capital value of the land.

West Hartlepool.—RAILLESS CARS.—The Corporation has under consideration an extension of the railless-car system on the Park route, at an estimated cost of £7,000.

Worcester.—FARES.—The Worcester Electric Tramway Co. has informed the City Council that it is prepared to abolish the existing twopenny through and return fares and to institute a penny single fare for reduced journeys for an experimental period of three months. The company will communicate with the Council as to the financial results obtained at the expiration of two months of the experimental period.

Telegraph and Telephone Notes.

France.—AUTOMATIC TELEPHONY.—A new automatic telephone exchange has lately been completed and put in operation in Dieppe.

Italy.—THE TELEPHONE SERVICE.—In transferring the Italian State telephone service from Government to private control, the country was divided into zones, and concessions granted in each separate zone. This plan not being acceptable to the American company interested, says *Commerce Reports*, its bid was withdrawn. Long-distance service will probably remain in the hands of the Government.

Police Wireless.—SATISFACTORY EXPERIMENTS.—The authorities at Scotland Yard, the *Morning Post* understands, are well satisfied with the progress that has been made generally in the utilisation of wireless for tracking criminals. The greatest strides have been made in the equipment attached to motor vans. Seven covered vans are now used daily, and the experiments carried out by Major Vitty and Mr. G. A. H. Wootton, who are in charge of the engineering branch at Scotland Yard, have resulted in the use of rejector circuits. Communication with Scotland Yard is established while on the run with ease and rapidity, and long-distance tests have also proved satisfactory. Four of the vans have invisible aerials, the wires lying flat along the roof, but in the latest the aerial consists of five wires mounted upon adjustable arms attached to the roof. The messages sent from and received by the vans are all coded.

Radio-Telegraphy.—NEW TRANSATLANTIC SERVICE.—As a consequence of the reorganisation of the Marconi station at Carnarvon, including an extension of the aerial system, a second direct radio-telegraph service between London and New York is now available for traffic.

The Telephone Service.—UNDERGROUND CABLES.—It is reported that 90 per cent. of the telephone line failures during the recent gales occurred in the overhead lines areas. According to the *Daily Mail*, during the ten months of 1924 ended on October 31st, 690 miles of underground cable were laid, involving the use of 174,200 miles of single copper wire, and it is expected that this figure will be considerably exceeded during this year. In 1914 the number of trunk calls recorded was 37,973,246. In 1923-24 the figure was 63,607,880, while for 1924-25 the total is expected to exceed 75,000,000. To cope with this development, all underground cables are being laid with sufficient ducts for requirements 15 years ahead on the estimated programme of enlargement.

KIOSKS.—Some time ago the Aylesbury Corporation agreed to the erection by the Postmaster-General of a telephone kiosk in the market square, and all arrangements were made, says the *Evening News*. But the permission of the Council has been withdrawn, as the Postmaster-General has intimated that on principle he cannot agree to pay the 5s. a year demanded by the Council for the privilege of erecting the kiosk. An annual payment of one shilling is, he says, as far as he can go.

Radio Notes.

Australia.—NEW "B" CLASS STATIONS.—In New South Wales six "B" class broadcasting stations are to be established by firms interested in the sale of radio material, says *Industrial Australian and Mining Standard*. These stations are distinct from the "A" class in that they will not receive any portion of the 35s. paid for each receiver's licence. Their return will be indirect, in the form of advertisement for themselves and stimulation of trade in radio goods. The new stations will operate on wavelengths below 560 metres.

Broadcasting Plays.—BAN DEFIED.—In spite of the opposition of the Association of Theatrical Managers, Mr. Donald Calthrop decided to broadcast his Kingsway Theatre revue "Yoicks" on Saturday evening. The Association had informed him that if he had the revue broadcast the contract for its provincial appearances would be cancelled. His reply was that, if necessary, the revue would be shown on fair grounds in the provinces, and he resigned his membership of the Society.

France.—PROPOSED NEW STATION.—According to *Commerce Reports* it is informally reported that the Cie. Francaise de Radiophone is requesting permission to erect a powerful broadcasting station at Marseilles in the near future.

Interference.—NORTHOLT INQUIRY.—Post Office engineers are inquiring into the allegations that the Government radio telegraph station at Northolt is responsible for the interference which has occurred of late with broadcast reception from 2LO and the other British home stations. Post Office experts have contended that Northolt is not the offending station, but both professionals and amateurs have made tests which suggest that their allegations are well founded, and they have convinced the Post Office that a further inquiry is justified.—*Morning Post.*

Irish Free State.—LICENCES.—About 2,700 licences for listeners have been issued in the Free State since licensing began last spring. The majority relate to sets in Dublin and neighbourhood. Undoubtedly, there are also many sets for which no licence has yet been obtained, and a great number are more or less home-constructed.

Norway.—PARLIAMENTARY PROCEEDINGS.—It is proposed to broadcast the proceedings at public meetings of the Norwegian Parliament.

Sweden.—PRIVATE CONTROL OF BROADCASTING.—The Aktiebolaget Radiotjäst, which has been given a broadcasting monopoly by the Swedish Government, took over the stations at Stockholm and Goteborg on January 1st, 1925. This organisation intends to improve the programmes, according to *Commerce Reports*, and will do a certain amount of broadcasting during the daytime.

United States.—NEW STATION.—A new American broadcasting station has been opened at Atlantic City. It has the call signal WBG, and appears to broadcast programmes rather better than the average run of American stations. The wavelength is 296 metres.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW *in which the "Official Notice" appeared in our advertisement pages.)*

Open.

Aberdeen.—Electrical plant and machinery, &c., for new factory at Dyce, near Aberdeen, for the Aberdeenshire Bacon Curing Factory, Ltd. Specifications from Messrs. Jenkins and Marr, surveyors, 16, Bridge Street, Aberdeen.

Australia.—SYDNEY.—February 18th. New South Wales Government Railways. Four 3-phase, 25-cycle, 500-kVA transformers. March 11th. One motor-driven ash exhauster.*

Municipal Council. March 2nd. 10,000-V feeder protective apparatus.*

February 4th. Public Works Department. Two motor-driven self-cleaning water screens.*

MELBOURNE.—March 23rd. Electricity Department. One 2,000-kW rotary converter, with transformer and accessories. Specifications from the City Electrical Engineer's office, Melbourne.

Basingstoke.—January 30th. Electricity Department. One 600-b.h.p. vertical heavy oil engine and direct coupled dynamo. (See this issue.)

Bedford.—February 12th. Electricity Committee. Replacing, altering, and rewinding single-phase a.c. motors and the modification of motor-driven machinery, where necessary, on consumers' premises. (See this issue.)

Belgium.—January 24th. Municipal authorities of Liège (Service de l'Electricité de la Ville). 1,500 cast-iron house-connection boxes and 1,200 T-shaped junction boxes. Particulars for 15 fr. for lot 1 and 10 fr. for lot 2 from Bureau Administratif des Services Industriels (Annexe de l'Hotel de Ville, deuxième étage).

Bredbury.—February 2nd. Bredbury and Romiley U.D.C. Supply and laying of 4-core lead-covered l.p. distributor cable. (See this issue.)

Dublin.—January 23rd. Dublin United Tramways Co. (1896), Ltd. A.c. and d.c. switchgear. (January 9th.)

Dundee.—January 19th. Electricity Department. A.c. and d.c. house-service meters for 12 months. (January 2nd.)

Egypt.—CAIRO.—February 15th. Ministry of the Interior. Pumping plant.*

Hull.—February 19th. Electricity Committee. Four water-tube boilers and accessories. (See this issue.)

Ilford.—January 27th. Electricity Department. One 1,000-kW La Cour motor converter; 1,500-kW rotary converter, transformer and switchgear; 660-V paper-insulated cables. (See this issue.)

India.—February 3rd. India Store Department. Electric cable. (January 9th.)

Keighley.—January 20th. Electricity Committee. One 350-kW rotary converter, transformer, h.p. and l.p. switchgear. (January 9th.)

Liverpool. — January 29th. Electricity Department. Stores and materials for 12 months, including electric meters, lamps, switches, fuses, &c. (See this issue.)

London.—H.M. OFFICE OF WORKS.—January 20th. 900 a.c. prepayment electricity meters. (January 2nd.)

BERMONDSEY.—January 22nd. Electricity Department. Stores for 12 months, including cables, jointing, &c., materials, conduits, meters, lighting and wiring accessories, &c. (January 2nd.)

METROPOLITAN ASYLUMS BOARD.—January 28th. Alterations and extensions to electric lighting installations at the Western Fever Hospital, Seagrave Road. (January 2nd.)

Installation of electric lighting, power, telephones, fire alarms, domestic bells in the three new ward blocks at Tooting Bec Hospital. (See this issue.)

Luxembourg.—February 7th. Municipal authorities of Libramont (Luxembourg). Extensions and modifications of the electricity distribution system in the town. Particulars for 20 fr. from Office Commercial de l'Etat, 15, Rue des Augustins, Brussels.

Manchester.—January 21st. Tramways Committee. 60 electric tramcar bodies, 60 pairs electric tramcar trucks, 120 electric tramcar motors, 120 electric tramcar controllers, or, alternatively, for the supply of 60 electric tramcars assembled complete. (January 9th.)

February 2nd. Electricity Committee. Three 1,00-kW motor converters or rotary converters; 11 750-kW do. do., five 3-wire automatic balancers; two negative boosters. (See this issue.)

Newport (Mon.).—February 2nd. Electricity Department. E.h.p. and l.p. switchgear. (See this issue.)

Pontefract.—Electric lighting installation at the factory of Messrs. W. R. Wilkinson & Co., Pontefract. (See this issue.)

Rumania.—BUCHAREST.—February 3rd. Rumanian State Railways. Porcelain insulators, sleeves and plates.*

South Africa.—JOHANNESBURG.—February 11th. Municipal Council. 50-h.p. electric motor.*

Uruguay.—MONTEVIDEO.—February 16th. State Electricity Works. Copper wire and cable.*

February 18th. 79,000 metres of lead-covered wires and cables.*

February 19th. 134,000 metres of v.i.r. wires and cables for indoor installations.*

February 20th. Fuse wire, bare copper wire, cut-outs, lampholders, switches, porcelain plugs and sockets, rubber tubing.*

February 27th. 3,000 d.c. meters and spares; 17,285 h. and l.p. a.c. meters and spares.*

March 3rd. Metal-filament lamps.*

March 6th. Round steel bars, iron rods, flat iron rods, sheets, &c.*

Uxbridge.—January 26th. Urban District Council. Electric fire hooter, fire alarm call system, and 4 public fire alarm call boxes. (See this issue.)

Warrington.—January 19th. Electricity Department. H. and l.p. paper- and lead-covered cables. (January 9th.)

Wetherby.—Complete or part equipment of generating stations for the supply of electricity to residents on the Davies estates, Wetherby and Bardsey, *viz.*:—Latest-type crude oil engines, generators, storage batteries, switchboards, &c.; also for laying main cables and supply of domestic motors, radiators, and fittings. Particulars from Mr. Edward Davies, North Grove, Wetherby.

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Barrow-in-Furness.—Electricity Committee. Accepted:—
Overhead lines, section I, £5,431; do. section II, £1,374; underground cable, £1,728.—Johnson & Phillips, Ltd.
Cable, transformers and switch panels required in connection with the supply to the Paper Works: Cable, £955, British Insulated & Helsby Cables, Ltd.; transformers, £1,055, Hackbridge Electric Construction Co., Ltd.; switchgear, £405, Johnson & Phillips, Ltd.

Belgium.—In respect of contracts for four small lots of armoured cables, junction boxes and insulating material required for the Belgian State Railway authorities, offers were received from Belgian, Dutch, Swiss, German, French, and British (Callender's Cable & Construction Co., Ltd.) concerns. Home manufacturers were, however, successful, the Société des Cableries et Corderies du Hainaut, of Dour, submitting the lowest tender for three of the lots and the Société des Ateliers de Constructions Electriques de Charleroi, for the fourth.

Belgian Congo.—The Belgian Ministry of the Colonies in Brussels recently opened tenders for the supply of three radio-telegraphic installations for the Belgian Congo. Offers were received from manufacturers in Belgium, Sweden, Germany, and Great Britain (Radio Communication Co., Ltd., London); the quotations ranged from 975,000 to 4,937,000 fr., the lowest being that of the Société Belge Radio Electrique, of Brussels.

Bradford.—Electricity Committee.
Erection of transformer chamber at Rooley Lane, Dudley Hill.—Wm. Garnett & Co.
Water piping for new No. 7 turbo-generator.—E. & W. Haley, Ltd.
Extensions to e.h.p. armour-clad switchgear.—A. Reyrolle & Co., Ltd.
Neutral earthing resistance for new No. 7 turbo-generator.—Metropolitan-Vickers Electrical Co., Ltd.

Tramways Committee.
15 tons Peckham hand-brake shoes (£157); 20 tons track brake blocks (£200).—Cole, Marchent & Morley, Ltd., Bradford.

Canterbury.—Town Council. Accepted:—
D.c. switchboard (£1,570).—English Electric Co., Ltd.

Chesterfield.—Corporation Electricity Department. Accepted:—
1,550 yd. .0225 sq. in. 3-core, 6,600-V cable.—Western Electric Co., Ltd.
250 yd. .05 sq. in. 3-core, 6,600-V cable.—British Insulated & Helsby Cables, Ltd.
E.h.p. switchgear in connection with the electrification of the new sewage works.—British Thomson-Houston Co., Ltd.
Electrical installations at housing estates.—S. H. Parsons (25 houses); E. R. Morris (44 houses).

China.—HANKOW.—The contract for transformers and switchgear for the Hankow Waterworks and Electric Light Co., Ltd., mentioned in these pages in July last, has been secured by Messrs. Arnhold & Co., Ltd., of Hankow, for equipment supplied by the Metropolitan-Vickers Electrical Export Co., Ltd.

Egypt.—An Exchange telegram states that the Associated British Manufacturers of Egypt, Ltd., has secured from the Egyptian Government, on behalf of Siemens Bros. and Co., Ltd., a contract for the installation of an automatic telephone exchange. The value of the contract is £50,000.

Faversham.—Town Council. Accepted:—
English cable (£320).—W. T. Glover & Co., Ltd. The tender for foreign cable was £519.

Glasgow.—Tramways Committee. Recommended:—
Storage battery for Paisley sub-station.—Oldham & Son, Ltd.
Armature for electric welding machines.—Scholey Construction Co., Ltd.
Steel tires.—J. Baker & Co., Ltd.
Fishplates for No. 5 section rail.—Bolckow, Vaughan & Co., Ltd.

Baths and Washhouses Committee. Accepted:—
Engineering work, &c., at new baths and washhouses at Dobbie's Loan (£5,254).—George Munro.

Corporation. Recommended:—
Electric lighting installation at Norham Street housing scheme (£2,979).—R. J. Sinclair.
Electric lighting installation at Knightswood Hospital.—Johnston, Park and Co.

Harrogate.—The Town Council decided at its meeting on Monday last to place its order for a 3,000-kW turbo-generator with Messrs. Fraser & Chalmers, Ltd., of Erith, for an all-British set, at £17,338. The chairman of the Electricity Committee said that 17 tenders were considered, and in October last four were left for investigation by a special sub-committee. At a meeting last Friday it was decided to leave it to the Council to say whether Harrogate should buy plant of absolutely British manufacture or a British turbine and a Belgian generator. On Monday, according to the report in the *Yorkshire Observer*, an amendment was moved accepting the tender of Messrs. W. H. Allen, Sons and Co., at £14,960, as recommended by the electrical engineer, and as approved by five members against two in committee. The mover said that the other firm had been given the opportunity of revising their tender, and it had reduced it. Under Messrs. Allen's tender the whole of the cost, with the exception of about £3,500 for the Belgian alternator, would have been spent in this country. In further speeches it transpired that the chairman and the engineer had both been to Belgium, and were of opinion that by taking the Belgian alternator they would have made a good saving. The Council decided to accept the tender of Messrs. Fraser and Chalmers.

Hull.—Telephones Committee. Recommended:—
Cable (£890).—W. F. Dennis & Co., Ltd.
Wire (£126).—Callender's Cable & Construction Co., Ltd.

In view of unemployment, the City Council last week rejected a German tender for telephone cable, which was £160 below the lowest British offer, and instructed the Telephones Committee to accept the lowest British quotation.

London.—L. & N.E. RAILWAY. Accepted:—
Electric lamps.—Edison Swan Electric Co. Ltd.

STEPNEY.—Electricity Supply Committee. Recommended:
Two new turbines capable of operating at a steam temperature of 700 deg F (£24,870, less £1,450 for the existing turbines).—Escher, Wyss and Co.

The Committee reports that Messrs. Escher, Wyss & Co.'s type of turbine is already in use for the turbo-generator sets, which it is now proposed to bring up to the standard necessitated by the new equipment of the Limehouse generating station, and the Council is accordingly compelled to look to Messrs. Escher, Wyss & Co. for the new equipment.

50 cast-iron chambers, frames and covers.—E. & F. Wright (£150). (Accepted.)

Works Committee. Accepted:—

Installation of electric light at the Canal Road depôt:—

Barrett & Wright, Ltd. (Accepted.)	**£115**
Barlow Bros.	117
J. Hearson & Co.	125
Electrical Installations, Ltd.	128
Ward Bros., Ltd.	136
Duncan, Watson & Co.	137

METROPOLITAN ASYLUMS BOARD. Works Committee.

Installation of electric light, High Wood Hospital for Children.

O. F. Williams (Accepted)	**£2,485**
A. Hawkins & Sons	2,960
Read & Partners, Ltd.	3 195
Coley & Swinnerton, Ltd.	3,198
W. H. Gaze & Sons, Ltd.	3,320
Toy & Winslow	3,390
T. Clarke & Co., Ltd.	3,400
G. E. Taylor & Co.	3,426
G. A. Weston	3,697
Cox-Walker & Partners	3,768
S. Reed & Sons	4,100
Griggs & Son	4,719

Stafford.—Electricity Committee. Recommended:—

3,000-kW turbo-alternator, with condenser, &c. (£15,510).—English Electric Co., Ltd.

Northampton.—Education Committee. Accepted:—

Installing electric light at Barry Road Intermediate School (£190).—Lowke and Sons.

Oldham.—Electricity Committee. Accepted:—

Earthenware cable ducts.—Doulton & Co, Ltd.

Cable.—Union Cable Co., Ltd.

West Bromwich.—Electricity Committee. Accepted:—

Plant for new sub-station at High Street.—General Electric Co., Ltd.

Wimbledon.—Electricity Committee. Recommended:—

74 switchgear equipments (200-ampere size) (£813).—George Ellison.

25 switchgear equipments (300-ampere size) (£570).—English Electric Co., Ltd.

Cast-iron economiser of 384 tubes, in conjunction with the two Spearing boilers at the electricity generating station (£3,000).—E. Green and Sons.

Liquid chlorine required by the Electricity Department during 12 months (£21 12s. 6d. per ton).—Castner-Kellner Alkali Co., Ltd.

Forthcoming Events.

Paisley Association of Electrical Engineers.—Tuesday, January 20th. At 16, High Street, Paisley. At 7.30 p.m. Paper on "Dynamic Balancing," by Mr. T. White.

Royal Institution of Great Britain.—Tuesday, January 20th. At 21, Albemarle Street, W. At 5.15 p.m. Lecture on "The Analysis of Spectra," by Prof. A. Fowler, F.R.S.

Electrical Contractors' Association.—Tuesday, January 20th. At the New Prince's, Piccadilly, W. At 6.30 for 7 p.m. Annual dinner.

Institution of Production Engineers.—Wednesday, January 21st. At the Engineers' Club, W. At 7.30 p.m. Paper on "Instruments and Gauges," by Mr. H. A. Randall.

Radio Society of Great Britain.—Wednesday, January 21st. At the Institution of Electrical Engineers. At 6 p.m. Address on "Matter and Radiation," by the President, Sir Oliver J. Lodge, F.R.S.

Electric Lamp Manufacturers' Association.—Thursday, January 22nd. At the Lighting Service Bureau, 15, Savoy Street, W.C.2. At 4.30 p.m. Lecture demonstration on "The Importance of Good Lighting to the Electrical Engineer," by Mr. W. E. Bush.

Institution of Electrical Engineers.—Thursday, January 22nd. At the Institution, Victoria Embankment, W.C. At 6 p.m. Paper on "The Design of Electrical Plant, Control Gear and Connections for Protection against Shock, Fire and Faults," by Mr. H. W. Clothier.

(Mersey and North Wales (Liverpool) Centre).—Monday, January 19th. At the Liverpool University. At 7.30 p.m. Lecture on "The Nature of Electricity," by Sir Oliver J. Lodge, F.R.S.

(North-Western Centre).—Tuesday, January 20th. At the Engineers' Club, Manchester. At 7 p.m. Paper on "Three-wire Direct-current Distribution Networks: Some Comparisons in Cost and Operation," by Mr. H. W. Taylor.

(Scottish Centre).—Tuesday, January 20th. At the Institution of Engineers and Shipbuilders in Scotland, 39, Elmbank Crescent, Glasgow. Informal meeting, lecture and demonstration on electric cooking, by Miss Kennedy, Glasgow Corporation Electricity Department, with introduction by Mr. R. B. Mitchell.

(North-Midland Centre, Students' Section).—Tuesday, January 20th. At the Technical College, Bradford. At 7 p.m. Address by the Chairman of the Centre, Mr. T. B. Johnson.

(London Students' Section).—Friday, January 23rd. At the Institution, Victoria Embankment, W.C. At 6.15 p.m. Paper on "Electro-pneumatic Signalling at Clapham Junction," by Mr. R. A. Powell.

(East Midland Sub-Centre).—Tuesday, January 20th. At the Technical College, Derby. At 6.45 p.m. Paper on "Some Points in the Manufacture and Installation of High-voltage Cables," by Mr. C. Beaver.

(Sheffield Sub-Centre).—Wednesday, January 21st. At the Royal Victoria Hotel, Sheffield. At 7.30 p.m. Paper on "Inventions and Patents," by Mr. W. E. Burnand.

Edinburgh Electrical Society.—Friday, January 23rd. At the Philosophical Institution, 4, Queen Street. At 8 p.m. Paper on "Industrial Illumination," by Mr. G. Herbert.

Junior Institution of Engineers.—Friday, January 23rd. At 39, Victoria Street, S.W. Paper on "Boiler-house Records and their Practical Value," by Mr. R. H. Parsons.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, January 23rd. At the Literary and Philosophical Society, Newcastle-on-Tyne. At 7.30 p.m. Lecture on "Railway Electrification in Switzerland," by Mr. E. A. Eborall.

Physical Society of London.—Friday, January 23rd. At the Imperial College of Science, South Kensington, S.W. At 5 p.m. Ordinary meeting.

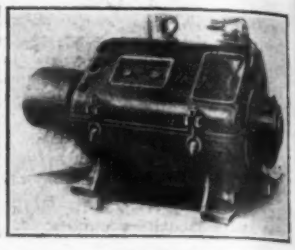
The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names of makers or suppliers of:—

CARBON CLOTH for resistances.

MULTIWAY PLUGS and SOCKETS up to 10 contact pins.



Can any reader inform us as to the makers of either of the machines illustrated above?

Notes.

Electric Light for Canterbury Cathedral.—The Dean and Chapter of Canterbury Cathedral, one of the finest examples of Early English architecture in this country, have asked Mr. Haydn T. Harrison, M.I.E.E., to prepare plans and specifications for a complete electric lighting installation. The work will be carried out as circumstances permit.

Patent Applications in 1924. — The number of patent applications during the past year was slightly lower than in 1923—31,281 against 32,621. The largest class of applications was that covering electrical inventions, and internal-combustion-engine inventions followed closely. An increased number of applications in respect of electrical and chemical inventions came from the United States and Germany.

Safety Lamps in Mines.—Lieutenant-Colonel G. R. Lane-Fox, M.P., Secretary for Mines, announces that on November 24th, 1924, he made an Order under Section 33 of the Coal Mines Act, 1911, approving for use in all mines to which the Act applies, subject to the conditions specified in the Schedule to the Order, the following types of safety lamps, *viz.*:—"Davis-Jackson" lamp; "Derby" miners' electric hand lamp; "Ceag" pillarless lamp No. 2; "Ceag" 4-volt pillarless lamp; "Cambrian" electric lamps, types A and B; "Oldham" electric lamp torch; and Wolf alkaline lamps Nos. 966 and 969.

The Order also amends the schedules to previous Safety Lamp Orders by substituting revised specifications, or amending the specifications of certain types of safety lamps already approved. Copies of the Order, which may be cited as "The Safety Lamps Order of November 24th, 1924," (price 8d. net), may be obtained from H.M. Stationery Office.

Appointments Vacant.—Instructor in cable jointing for the Army Vocational Training Centre, Hounslow. Technical assistant for the Borough of Chesterfield Electricity Department. First-class fitter-driver for small Diesel central station. Mains assistant for the Borough of Darwen electricity department. Junior charge engineer, for the City of Carlisle electricity department. (See our advertisement pages to-day.)

Local Society.—STEAM BOILERS.—Mr. G. W. L. Wolland, A.M.I.E.E., station superintendent of the Norwich tramways, recently lectured on "Boilers" to members of the Norwich Engineering Society, under the chairmanship of the president, Mr. F. M. Long, A.M.Inst.C.E., M.I.E.E., city electrical engineer. Nearly 70 slides illustrated the lecture, models were exhibited, and a special feature was an electrically-fired boiler fitted with glass tubes for showing the circulation of the water in vertical water-tube boilers. The property of the lecturer, it was stated to be the first of its kind yet tried, and was operated by him with every success. The lecturer dealt with the factor of safety and the bursting pressures of steam vessels, and reviewed English, French, and American boilers. The last-named, of the George T. Ladd and Kidwell Companies types, he said, appeared to eclipse anything yet attempted in England for output, but he was not in favour of such large units as were used in the United States. An interesting discussion followed.

Danish Wiring Regulations.—The above subject was recently dealt with in *Commerce Reports* by an American trade official at Copenhagen. He states that the strictness of the rules, which are, in general, administered by municipal authorities, is such as to preclude the use of certain American fittings. A sharp distinction is drawn between wiring materials and devices approved for use in dry rooms and those permitted in places exposed to dampness. No switches or contacts are allowed in bathrooms, and wiring in wooden casing is banned. All installations must be carried out by firms or persons authorised by the Government.

A Novel Electric Ferry Boat.—A unique application of electric power is found in an electrically-driven ferry boat operating on the Willamette River at Independence, Ore., United States. The boat is driven by a 20-h.p., 440-V, three-phase motor, connected to side wheels through a Fordson tractor transmission, giving high and low speed and reverse. Power is supplied to a trolley circuit consisting of three ¾-in. Siemens-Martin galvanised-steel cables stretched 1,200 ft. across the river. Trolley wheels supported on a pantograph and a three-conductor flexible cable complete the electrical connection to the motor. The electric drive replaces a petrol engine with propeller. Under the old system a round trip took from 15 to 30 minutes, the operating cost averaged $150 per month, and there were frequent idle periods for repairs. With the electric drive the ferry operates continuously, and can make a round trip in less than five minutes. Over a period of five months, during the busiest season of the year, the power cost has averaged $60 per month. The ferry is owned by adjacent counties and renders free service.—*Electrical World.*

The Southern Railway. — On January 8th, Sir Herbert Walker, general manager of the Southern Railway, received a deputation of civic officials from places on the company's system in connection with the complaints which have become very frequent regarding the working of the Southern Railway. Sir Herbert Walker stated that the system was suffering from a lack of capital expenditure during a period of ten years, and the condition of rolling stock. He promised that the electrification which was in progress would considerably improve matters. In the meantime the position was being made worse by the withdrawal of carriages which were being converted for electric traction. There would be 695 coaches on the electric services and the bulk of these would be converted steam stock. It was hoped to open the Brighton extension in March, and the first section of the South-Eastern electrification and the Guildford and Dorking extensions in August. The other two sections of the South-Eastern system would be put into service at intervals of four or five months.

The Kearney High-Speed Railway.—On January 7th, the Minister of Transport received a deputation organised by the Kearney Society, which urged that consideration should be given to the possibility of constructing Kearney high-speed tube railways under the Thames, between Woolwich and North Woolwich, and the Tyne, from North to South Shields. Mr. E. W. Chalmers Kearney, the inventor of the system, outlined the nature of the proposals, and he was supported by a number of representatives from the Woolwich district who considered that the scheme would be remunerative and more suitable than an extension of the existing Tubes.

The attitude of the Minister remains uncertain. Early reports attributed to him a statement that no more money could be found for Tube extensions, and that the interest on the capital invested in the Kearney scheme would be guaranteed by the Trade Facilities Committee, but on the following day an official disclaimer was issued.

Institution Notes.

Institution of Electrical Engineers.—WESTERN CENTRE.—On Monday last the annual dinner of the Western Centre was held at the Grand Hotel, Bristol, following a meeting at which the President, Mr. W. B. Woodhouse, delivered an address.

At the dinner the chair was taken by Mr. W. Nairn (chairman of the Centre), and he was supported by Mr. W. B. Woodhouse, Mr. C. E. Barry (president of the Chamber of Commerce), Mr. H. Faraday Proctor (chief engineer and manager, Bristol Corporation electricity department), Ald. A. A. Senington (ex-Lord Mayor), Col. Sydney Smith, Mr. W. A. Chamen (president, South Wales Institute of Engineers), and other distinguished guests.

Mr. C. E. Barry proposed the toast of "The Institution of Electrical Engineers," remarking that they had had an example that night that they were not perfect. It was not the first time they had been "dimmed" in Bristol. A few years ago on the occasion of the law students' dance the electric light failed in the middle of the dancing, and the students afterwards passed a vote of thanks to the city's electrical engineer.

Mr. W. B. Woodhouse, in reply, said that the Institution was very rapidly progressing because the industry in which electrical engineers were engaged was also growing so very rapidly. Nowadays they could do practically nothing without electricity, which had made an important contribution to the country's industrial development when conditions were far from what they desired them to be. He thought that to-day they had the assurance of a much happier spirit and a greater prospect of men being employed contentedly in industry. In their own industry of electricity supply the relations between employers and employed were of a most harmonious kind, and they had set an example to the rest of the industry in this country by agreeing to settle all differences by arbitration.

The Chairman gave the toast of "Our Visitors," and Ald. A. A. Senington replied, referring to the advantages of cheapened electricity for lighting and cooking purposes.

The toast of "Kindred Societies" was proposed by Mr. H. Faraday Proctor, and Mr. W. A. Chamen, in reply, said that the fame of the president of the Institution of Electrical Engineers had extended far and wide. Col. Sydney Smith (president, Bristol Association of Engineers) stated that one-sixth of their members were members or associate members of the Institution.

PROGRAMME.—The arrangements for the remainder of the current session in London include the following items:—

February 5th.—Kelvin Lecture, on "Electrical Forces and Quanta," by Prof. J. H. Jeans, F.R.S.
February 12th.—Annual dinner.
February 19th.—Paper on "Electricity in Mines," by Major E. I. David.
March 5th.—Paper on "The Post Office and Automatic Telephones," by Col. T. F. Purves, O.B.E.
March 19th.—Paper on "Permanent Magnets in Theory and Practice," by Mr. S. Evershed.

Junior Institution of Engineers.—In his presidential address, Dr. Alexander Russell, F.R.S., sounded a note of encouragement to the engineers of the future in referring to the autobiography of Prof. Michael Pupin, of New York, inventor of the "Pupin" coil, who started life as a herd boy in Serbia, his native land. He drew attention to the fact that the work of converting the telephone system of London into one of automatic switching, work which will take 15 years to complete, had already been started, and also pointed to the marvellous progress made in telephone engineering in the past 50 years, there being now over 20 million telephone exchange stations in the world. The air mail service, said Dr. Russell, would not be a great rival to teletype telegraphy; it took four hours to send a letter from London to Paris, whereas by the new telegraphy a long printed telegram could be received in 10 minutes. He also made reference to the recent experiments by Marconi and Franklin with short waves, by means of which they were able to communicate with New South Wales for 23¼ hours out of 24, and suggested that the expensive long-wave stations might become obsolete.

In referring to Sir Ernest Rutherford's atomic theory, Dr. Russell pictured a passive lump of lead appearing to an intelligent being whose size was comparable to that of an electron, to be a galaxy of moving atoms with their attendant satellites whirling round them with gigantic velocities. Reference was also made in the paper to the rapid strides made in meteorology and to the records made by meteorologists of the currents which are continually flowing from the air to the earth, and to the theory of Prof. Mathias that a lightning flash is air rendered incandescent by an electric discharge.

Dr. Russell expressed the belief that the teaching of a few practical subjects effectively was of greater value to engineering students than the study of a heavily-laden curriculum. It was in the national interest that boys from the public schools should be attracted to the engineering profession, for the welfare of the country depended upon the prosperity of the engineering industries.

Association of Municipal Engineers of South Africa.—CONVENTION.—The annual convention of the Association was opened by the Mayor of Durban, Councillor T. M. Wadley, J.P., on December 8th. Over 40 delegates were present. A number of papers were read, including a report on the World Power Conference by the Association's delegate, Mr. B. Sankey, M.I.E.E., general manager of the Johannesburg Municipal Gas and Electricity Department. Visits were made to places of engineering interest in and around Durban, including the new graving dock. The Convention concluded with a smoking concert on December 12th.—*South African Power Engineer.*

Diesel Engine Users' Association.—Mr. A. W. A. Chivers (British Electrical Federation, Ltd.) has been re-elected president of the Association for the year commencing January 1st, 1925. At the December meeting the joint honorary secretaries' annual statement was presented concerning the progress made in the work of the Association; it shows that the total membership at the end of the year was just over 400, the increase for the year being 43.

Our Personal Column.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* ELECTRICAL REVIEW *posted as to their movements.

Stepney Borough Council Electricity Supply Committee has appointed Councillor ROSENTHAL chairman, and Councillor HASTED vice-chairman for the ensuing year.

Tunbridge Wells Town Council has referred back for reconsideration a recommendation by the Lighting Committee to grant £600 to the borough electrical engineer, Mr. R. N. TORPY, and £150 to the assistant engineer, Mr. J. E. POWNALL, for services rendered in connection with the installation of new machinery at the electricity works.

Mr. FRANK G. GIBSON, chief mechanical and electrical engineer to the Whitehaven Colliery Co., Ltd., has accepted a similar appointment with the Charlow & Sacriston Collieries, Ltd., County Durham.

We learn that Mr. HARRY BOOTH, O.B.E., one of His Majesty's Electricity Commissioners, is retiring from office on January 24th, after completing over 40 years in the public service.

Birkenhead Town Council has approved of the following alterations in salaries: Electrical engineer—present salary, £825; proposed salary, £800—£1,000, by annual increments of £50, commencing at £900. Tramways manager—present salary £750, bonus £149, motor-car allowance of £50; proposed salary, £800—£1,000, by annual increments of £50 maximum.

The Rotherham Town Council has increased the salary of Mr. CROSS, its electrical engineer, to £1,350.

Mr. S. C. PRICE asks us to state that his appointment with the Burma Oil Co. is that of shift engineer, not "engineer" as stated in the ELECTRICAL REVIEW for November 28th.

Mr. T. ANDERTON, the treasurer of a fund that is being raised on behalf of Mr. J. Lane, late of the Bridge Electrical Co., who has been stricken with blindness, informs us that he has received from Mr. J. C. White a donation of five guineas, his share of the first prize in a recent competition of the St. Helens Cable & Rubber Co., Ltd.

MR. JOHN F. AVILA has joined the firm of Messrs. John Sterling & Co., advisory engineers, of 66, Victoria Street, London, S.W.1, who specialise in factory and industrial equipments and in lighting and power installations for industrial works.

MR. A. J. B. HARRIS, until recently testing officer in charge of wireless receiving instruments and valves at the Signal School, Royal Naval Barracks, Portsmouth, has joined the technical staff of Messrs. Radio Instruments, Ltd., as superintendent of their testroom.

Barrow-in-Furness Electricity Committee has recommended to the Council Standing Committees Sub-Committee that the maximum salary of the Borough Electrical Engineer be £950 per annum.

The *South African Power Engineer* states that Mr. JOHN ROBERTS, M.I.E.E., borough electrical engineer of Durban, has been elected president of the S.A. Association of Municipal Electrical Engineers, and Mr. B. SANKEY, vice-president.

Obituary.—MR. J. B. HAMILTON.—We record with feelings of deep regret the death of Mr. John Bailie Hamilton, at the age of 69 years. He had been in poor health for some time, and on Saturday, January 3rd, he went, on his doctor's orders, from Leeds, where he resided, to Bath, where on Friday afternoon he passed away as the result of a seizure by which he was attacked in the morning. Mr. Hamilton is remembered as one of the foremost tramways managers of the United Kingdom. At the time of his death he was still tramways manager and commercial manager to the Leeds Corporation, as well as chairman of the Bath Tramways Co., Ltd. His connection with tramways began in 1883, when he was appointed general manager of the London Tramways & Omnibus Co. Later he became traffic manager at Glasgow. His appointment as tramway manager at Leeds dates back to 1902, and in 1914 the Corporation of that city recognised his special gifts and qualifications by appointing him also to the then new post of commercial manager, in which capacity he had control over 8,000 employés of all grades engaged in the tramways, cleansing and highways departments. He had a prominent association with the Municipal Tramways Association, of which he had been president, with the Tramways and Light Railways Association, of which he had been vice-chairman, with the Institute of Transport, and other organisations, while he was also on the Tramways National Joint Industrial Council and other industrial councils. During the war his services were requisitioned by the Government for important work under the Admiralty, and as Director-General of Transport under the Ministry of Food. One of his sons was killed in the war. He leaves a widow, four sons, and three daughters. Mr. Hamilton had arranged to deliver an address on Monday last at the Yorkshire Section of the Institute of Transport at Leeds, on "Modern Street Urban Transport." A tramway dance which had been fixed for Friday night last was cancelled.

MR. P. F. SMITH.—The death occurred on December 24th last of Mr. Percy Frost Smith, one of the pioneers of the electric vehicle in this country. The deceased was connected for many years with Thomas Tilling, Ltd., and was associated with the development of the Tillings-Stevens petrol-electric motor-'bus. Later he developed a petrol-electric chassis of his own design, and placed a number of "F.S." 'buses in service in London.

MR. A. H. JARRETT.—The death took place on January 6th, in his 58th year, of Mr. Albert Henry Jarrett, managing director of the Shipston-on-Stour Electric Lighting Co., Ltd.

New Companies Registered.

The Sudan Light & Power, Ltd. (202,952).—Registered as a "public" company on January 7th, with a nominal capital of £356,000 in £1 shares. The objects are:—To construct, equip, improve, work, develop, administer and control public works and conveniences in the Sudan or elsewhere, including railways, tramways, docks, harbours, bridges, piers, wharves, canals, reservoirs, embankments, irrigation, reclamation, sewage, drainage, sanitary, water, ice, gas, electric light, telephonic, telegraphic, and power supply works, &c. Minimum cash subscription, 7 shares. The number of directors is not to be less than two nor more than ten. The first directors are:—The Rt. Hon. Baron Meston, of Agra and Dunottar, K.C.S.I., Hart, Cookham Dene, Berks., director of English Electric Co., Ltd.; Sir Thos. O. Callender, Bidborough Court, near Tunbridge Wells, Kent, managing director Callender's Cable and Construction Co., Ltd.; Col. F. J. Byrne, C.M.G., 36, Sloane Court, S.W.3, director, Dorman Long & Co., Ltd.; P. J. Pybus, C.B.E., 21, Whitehall Court, S.W.1, managing director of English Electric Co. Ltd.; Sir Geo. E. May, K.B.E., Bucknalls, near Watford, Herts, secretary to Prudential Assurance Co.; Lt.-Col. G. E. Schuster, C.B.E., M.C., Nether Worton House, Steeple Aston, Oxon., financial secretary to Sudan Government. The Sudan Government had the right to nominate one director, Lt.-Col. G. E. Schuster being the first nominee. Qualification (except nominee of Sudan Government), £100. Remuneration (except managing directors) such sum not exceeding £1,000 per annum, divided between them, as may be voted by the company. Secretary: P. Horsfall. Solicitors: Lawrence Webster, Messer and Nicholls, 14, Old Jewry Chambers, E.C. The registered office is at Queen's House, Kingsway, W.C.2.

Luth and Rosen Electric Co., Ltd. (202,972).—Private company. Registered January 8th. Capital, £1,000 in £10 shares. To carry on the business of importers and manufacturers of, agents for and dealers in electrical and mechanical machinery, apparatus, instruments, cables and combined equipments of all kinds, generators, motors, transformers, pumps, compressors, fire engines, locomotives, power transmitting machinery, gearing, refrigerating plant, &c. The first directors are:—H. Duse, Heovslagare gatan 3, Stockholm (managing director of Luth and Rosens Elektriska Aktiebolag); J. J. Fasola, 3, Wolseley Road, N.8, chartered electrical engineer; W. G. Schmidt, Villa Soderasen, Sattsjobaden, near Stockholm. Qualification, 2 shares. Registered office: 75, Victoria Street, S.W.1.

Kinsey's of Croydon, Ltd. (202,907).—Private company. Registered January 6th. Capital, £2,500 in 5,000 founders' shares of 1s. each and 2,250 ordinary shares of £1 each. To carry on the business of motor, electrical, mechanical and general engineers, manufacturers and repairers of and dealers in motor and other vehicles, &c. The provisional directors are:—A. E. Jackson, The Beeches, Ham Farm, Shirley, Croydon, certified accountant; W. T. Jackson, The Beeches, Ham Farm, Shirley, Croydon, brewery representative; J. R. Kinsey, A.M.I.E.E., 58, Woodside Court Road, Addiscombe, Surrey, chartered electrical engineer. Qualification, £50 shares.

Magna Wire and Cable Co., Ltd. (202,016).—Private company. Registered January 9th. Capital, £11,000 in 10,000 8 per cent. non-cumulative preference shares of £1 each and 20,000 ordinary shares of 1s. each. To carry on the business of electrical engineers, manufacturers of and dealers in cables, wires, lines, accumulators, lamps, machinery, fittings, tools, &c. The subscribers (each with one share) are: G. Smith, 3, Roksole Gardens, Crouch End, Hornsey, N., secretary; A. W. Smith, 75, Limes Road, West Croydon, Surrey, secretary and engineer. The subscribers are to appoint the first directors. Qualification, £5 shares. Remuneration as fixed by the company. Secretary: G. Smith. Registered office: 137, Victoria Street, S.W.1.

Art Wares, Ltd. (202,989).—Private company. Registered January 9th. Capital, £1,500 in £1 shares (1,000 ordinary and 500 10 per cent. cumulative preference). To carry on the business of wholesale or retail manufacturers and distributors of electric art lamps and shades and all accessories, &c. The first directors are:—W. C. Hawkes, 1, Redington Court, Church Road, Hove; J. G. Graham, 78, Canterbury Road, North Harrow. Qualification, £50 shares or stock. Remuneration as fixed by the company. Registered office: 118, Hart Street, W.C.1.

Siemens-Schuckert (Ireland), Ltd.—Registered in Dublin on January 7th with a nominal capital of £10,000 in 10,000 ordinary shares of £1. The objects are:—To carry on the business of engineers, electrical engineers, electricians, suppliers of electricity, &c. The first directors are:—Dr. Harald Wallem, Dahlem, 59, Miguel Strasse, Berlin, electrical engineer; L. F. Kilegyi, 16, Helenslea Avenue, Golders Green, London, N.W.11, consulting engineer. Manager: Thomas A. McLoughlin. Registered office: Ulster Bank Chambers, 3/4, Lower O'Connell Street, Dublin.

Cymbal, Ltd. (202,962).—Private company. Registered January 8th. Capital, £200 in 2s. shares. To carry on the business of exporters, importers and manufacturers of and dealers in wireless and other instruments and their parts, motor accessories, motor boats and their component parts, drugs and chemicals, shipbreakers, contractors, &c. The first directors are:—A. H. Ballard, "Jersey," Vernon Road, Leigh-on-Sea; D. Simpson, Thistle House, Marine Parade, Leigh-on-Sea. Solicitor: M. Lemon, 11, Station Road, Finsbury Park, N. Registered office: 51-2, Fenchurch Street, E.C.3.

Moncrieff Brothers, Ltd. (13,459).—Private company. Registered in Edinburgh January 2nd. Capital, £4,000 in £1 shares (3,000 ordinary and 1,000 deferred). To acquire the works, machinery, &c., belonging to James Cooper Moncrieff, and to carry on the businesses of electrical and general engineers, &c. The subscribers (each with one share) are:—J. C. Moncrieff, Tower Bank, Leven, Fife, engineer; E. A. C. Moncrieff, 7, Greenmount Terrace, Burntisland, engineer. The first directors are not named. Qualification, £50 shares. Solicitor: F. T. Wallace, Supreme Courts of Scotland, Leven.

British Portable Radio, Ltd. (202,845).—Private company. Registered January 3rd. Capital, £6,000 in 5,000 preference shares of £1 each and 20,000 ordinary shares of 1s. each. To adopt an agreement with R. Adey, and to carry on the business of manufacturers of and dealers in portable wireless machines, &c. The directors are:—R. Adey, Avenue Chambers, Southampton Row, W.C.1, engineer (managing and permanent director); C. D. Rich, The Berkeley Hotel, Piccadilly, W., hotel manager; Lt.-Col. C. A. Leslie, J.P., Balquhain, Aberdeenshire; and Lady Therese Muir Mackenzie, 25, Pelham Place, S.W. Qualification, £250. Remuneration as fixed by the company. Solicitors: Greene and Underhill, 31, Bedford Row, W.C.1.

Official Returns of Electrical Companies.

Melbourne Electric Supply Co., Ltd.—Trust deed dated December 18th, 1924, to secure £300,000 debenture stock with contingent premium of 3 per cent. charged on the company's assets, present and future, including uncalled capital. Trustees: Melbourne Trust, Ltd., 25, Moorgate, E.C.

Poynter Griffiths & Co., Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated December 24th, 1924, to secure all moneys due or to become due from the company to Barclay's Bank, Ltd.

Haywards Heath and District Electric Supply Co., Ltd.—Debenture dated December 23rd, 1924, to secure £3,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: T. White, Haywards Heath, Sussex.

Maybrook Electrical Co., Ltd.—Particulars filed of £1,000 first and £1,000 second debentures authorised December 18th, 1924, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued in each case.

D. Hulett & Co., Ltd. (169,979).—Return dated December 4th, 1924. Capital, £5,000 in £1 shares. 4,420 shares taken up. £20 paid. £4,100 considered as paid. Mortgages and charges, nil.

British Brown-Boveri, Ltd. (formerly Brown, Boveri and Co., Ltd.) (89,167).—Return dated October 15th, 1924. Capital, £50,000 in £1 shares. All shares taken up. £2 10s. per share called up on 8,500 shares. £1 per share paid. £7,500 considered as paid on 1,500 shares. Mortgages and charges, *nil*.

Drake & Gorham, Ltd. (70,275).—Return dated October 1st, 1924. Capital, £125,000 in £1 shares. All shares taken up. £85,000 called. £80,000 considered as paid. Mortgages and charges, £12,000.

Fallon Condenser Manufacturing Co., Ltd.—Satisfaction in full on December 24th of debenture dated April 3rd, 1924, securing £250.

Rhondda Tramways Co., Ltd.—Satisfaction to the extent of £6,400 on October 23rd, 1924, of charges dated March 24th, 1911, November 13th, 1912, and March 11th, 1915, securing £250,000.

A. W. Beuttell, Ltd.—Satisfaction in full on December 1st, 1924, of debenture dated January 5th, 1923, securing £674 2s. 11d.

Re-Echo Electrical Manufacturing Co., Ltd.—C. F. Richards, of 12, Chandos Road, W.17, ceased to act as receiver or manager on October 3rd, 1924. (Notice filed January 3rd, 1925.)

Marconi's Wireless Telegraph Co., Ltd. (53,403).—Return dated August 29th, 1924 (filed October 9th). Capital, £4,000,000 in £1 shares (3,750,000 ordinary and 250,000 7 per cent. cumulating participating preference). 2,750,065 ordinary and 250,000 preference shares taken up. £2,884,040 paid on 2,634,040 ordinary and 250,000 preference. £116,025 considered as paid on 116,025 ordinary. Mortgages and charges, £1,504,411 12s. 4d. Satisfaction to the extent of £70,236 on November 25th, and to the extent of £33 on November 28th, 1924, of debenture stock dated November 17th, 1922, securing £1,500,000.

City Notes.

Marconi Wireless Telegraph Co. of Canada, Ltd.

The annual meeting of the company was held in Montreal on December 18th. It was stated that a loss of $39,144 had been incurred on the business during 1923. Reference was made to the proposed construction of "beam" stations in England and Canada, and it was said that this would lead to the expansion of the company's business. To finance the new developments it was proposed to issue common stock. It was, however, impossible to secure a purchaser for this until the par value of the existing stock was reduced so as to cover depreciation, obsolescence, &c. It was therefore proposed to reduce the capital stock from $7,500,000 to $3,000,000 by reducing the par value of the shares from $2.50 each to $1. Then the capital would again be raised to $7,500,000 by the issue of 4,500,000 shares of the par value of $1 each. A large part of this would be purchased by Marconi's Wireless Telegraph Co., Ltd., and the balance by existing stockholders, if they so desired.

Allgemeine Elektricitats Gesellschaft.

In their report for the year ended on September 30th, 1924, the directors state that after the first few months business gradually revived, and the final months were more favourable. The outlook continued serious, but there was activity in all branches of applied electricity, and the degree of employment at the company's works was satisfactory. The apparatus works were only able to obtain large orders—especially from abroad—at prices which in part were greatly reduced. In the second half of the year a slight improvement took place so that the output almost reached the average of the pre-war period. The works took up the manufacture of radio-receiving apparatus in conjunction with the associated Telefunken Gesellschaft. The cable factories had been very busy in the departments for light and power and telephone cables, particularly for long-distance cables, while the departments for conductors, insulating materials, insulating tubes, and the metal branches suffered owing to the lack of activity in the building trades. As compared with 1922-23 business in electric locomotives showed an improvement and promised further favourable development. At the Brunnenstrasse machine works the orders for tramway motors and controllers exceptionally increased as the tramway companies, which for years had been unable to undertake the renewal of their rolling stock, now had the requisite funds at their disposal for the purpose. The importance of the transport problem for all works was leading to an increasing demand for electric vehicles. During the year it was necessary to transform the construction of steam turbines. While until then it had been appropriate to construct cheap turbines of a moderate efficiency, the increase in the price of coal had rendered it necessary to bring out machines of the highest efficiency. This could only be accomplished by a greater use of materials, a greater number of stages, lower steam velocities, and larger outputs by means of the multiple cylinder type of turbine. These improvements had induced the owners of old turbo-dynamos to modernise the steam parts and to exchange the older turbines for those of modern construction, while the existing dynamos and condensing installations were retained.

The department for central stations was confronted with many new problems. The Brunswick electricity works ordered from the company an extension of the works by 10,000 kW. Steam turbines or turbo-dynamos of up to 25,000 kW were ordered for the extension of existing stations, and the company was constructing a power station on the new oilfield in Comodore Rivadavia for the Argentine Government. Orders were also received for generators for hydro-electric works and for converters and large rectifier installations. Many transformers of large capacity were delivered, including some for 32,000 kW. After referring to the contracts for high-pressure switch installations for power stations and transforming works and high-pressure lines for from 50,000 to 100,000 volts, the report records a revival of business in connection with the electrical equipment of mines and ironworks, and also mentions that increased sales of electric welding equipment took place.

The accounts show net profits of 7,223,000 Reich (gold) marks for the past financial year, the method of disposal of which has already been noted in this journal.

Ferguson, Pailin, Ltd.

The report of the directors for the year ended November 30th, 1924, shows a net profit of £30,068. To this is added £24,300 brought forward, less the balance of E.P.D. for the two years ended November 30th, 1920, and Corporation Profits Tax for the four years ended November 30th, 1923, the final liability of which was settled during the year at £12,611, leaving £11,689, making a total available of £41,757. After paying the full 8 per cent. on the preference shares, 13 per cent. on the ordinary shares, and "covering the special condition contained in the prospectus in relation to the ordinary shares issued thereunder," £5,000 is put to reserve and £25,104 remains to be carried forward. Some improvement in trading was experienced during the year and the directors consider the results satisfactory. A further amount of capital is likely to be needed during the present year and the existing members will have the first opportunity of subscribing it. The annual meeting is to take place at the registered office at Higher Openshaw, Manchester, on January 22nd.

Stock Exchange Notice.—Dealings in the following have been specially allowed by the Committee under Rule 159:—
Electrolytic Zinc Co. of Australasia.—£400,000 8 per cent. first mortgage debentures (registered), Nos. 1 to 40,000.

Belgian Company.—The report of the *Société de l'Electricité du Brabant*, of Brussels, for the last financial year shows a net profit of 1,447,852 fr. as compared with 1,432,248 fr. in 1922-23.

Italian Companies.—The *Società Elettrica Bresciana* has recently invited applications for 200,000 new shares of 100 lire each, at par.

The *Società Elettrica Sarda*, of Turin, is also inviting subscriptions for 250,000 new shares of 100 lire each at 110 lire.

Canadian General Electric Co.—It was reported in our issue of November 28th last (p. 828), that the company proposed to issue to the General Electric Company, of New York, 52,000 each of 7 per cent. preference shares and common shares at the par value of $50. In response to protests by shareholders the company has agreed to allow them to take up a part of the new issue at the rate of three preference shares for every seven held, and three common shares for every eight held.

Chili Telephone Co., Ltd.—An interim dividend of 3s. per share has been declared.

Kaministiquia Power Co., Ltd. — The dividend on the common shares for the quarter ending January 31st is $2 per share.

American Telegraph and Telephone Company.—A syndicate headed by Messrs. Morgan has purchased 125 million dollar, thirty-five year, 5 per cent. debenture bonds of the American Telegraph and Telephone Company. The proceeds will be devoted to granting loans to associated companies or to the acquisition of their securities.—*Reuter* (New York).

German Cable Companies.—It is reported that the directors of the German-Netherlands Telegraph Co. propose to recommend to the shareholders that the undertaking should be amalgamated with the German Atlantic Telegraph Co. The former also had to cede its cables under the Treaty of Versailles, and its negotiations with the Government in the matter of compensation have not yet been brought to a conclusion.

Edmundson's Electricity Corporation, Ltd.—A dividend at the rate of 6 per cent. has been declared on the ordinary shares for the half-year.

Vulcanite, Ltd. — The report for 1923-24 shows a net profit of £1,853, as compared with £1,356 in the preceding year. With the balance brought forward a sum of £2,561 is available, and, after the provision of the balance necessary to meet the preference dividend, £2,246 is carried forward. No dividend is being paid on the ordinary shares.

Stocks and Shares.

MONDAY EVENING.

IN the ordinary course of events, the Stock Exchange week would have started off in a cheerful frame of mind. As it was, however, the fog descended upon everything and checked business in all the markets. Therefore, instead of the week starting with activity, a certain amount of hesitation crept

into the Stock Exchange. In the absence of a fresh buying movement, prices tended to sag. This disposition did not apply to shares in the manufacturing companies concerned with electricity and cable work. In their market, rises are numerous and substantial. The buyer is insistent upon having his way, and the supply of shares has run lamentably short.

The principal improvement is one of 3s. in Babcock and Wilcox, the price having soared to 56s. Iron, coal and engineering shares generally are better, on the assumption that trade is on the point of revival, and that, with Continental politics in a fair way to becoming settled, the field of International operations will open more profitably than ever to the British companies able to take advantage of the opportunities offered them. It is thought, moreover, that wide scope exists, and is likely to be utilised, in connection with Colonial markets, the present Government being credited with the intention of not only fostering, but stimulating, British trade as far as possible. This, it is scarcely necessary to add, is no mere political view, but is a reflex of the reasons that are operating to advance prices in the shares of manufacturing companies.

General Electrics at 23s. 9d. are 2s. 6d. higher; Electric Constructions at 35s. are ¼ up, so are Cromptons at 12s. 6d. Callenders are equally better at 3 1/16. British Aluminium followed up their big rise of last week by a further improvement of 1s. 6d. to 33s. 9d. Prices have now reached an average level of yield which looks extremely inadequate, but which is expected, of course, to be left well behind by the next batch of dividend declarations. Possibly the rises have gone far enough in discounting the future, but however this may be, the fact remains that investment is extremely eager to obtain shares in the leading companies, and that holders of these are in no mood to part with them except at tempting prices. Edisons went up with the rest, and at 6s. 3d. are 6d. to the good. Where prices show no change, this does not mean that the market has remained stagnant. It simply indicates that jobbers have not seen fit to put up the prices, though in all probability they have buyers of the shares.

Automatic Telephones remain at 28s. 6d., International Telephones have risen to 24s. One feature is another rise in Radio Common, the shares advancing to 14 before they reacted to 13¼. The preferred are steady at 10¼. Canadian Marconis, after being 5s. 6d., lost the pence. Marconis put on another 1/16 at 33s. 9d.

Shares in the home electricity supply companies are again better. Charing Cross ordinary, City of London ordinary, London Electric of both classes, Westminsters and Newcastle-on-Tyne ordinary, are all higher on the week. Newcastle and District, it may be mentioned, have risen to 20s., and provincial shares as a whole sympathise with the upward tendency shown by the prices of the London companies. The first dividends are expected to be out towards the end of next month. Whitehall Electric preference stand once more at par, namely, 20s.

Amongst cable stocks, the investor is again making himself very evident. Eastern Extensions and Eastern Telegraph ordinary stock recovered with ease the dividends of 5s. and 2½, respectively, deducted from the prices last Thursday. The 4 per cent. debenture stocks of the Western, Eastern and Eastern Extension are all better at 80½. Pacific and European debenture at 79½ is 1 higher. The Anglo-American group is a little harder, but the main feature of the market is, as already noted, the strength shown by the shares in the manufacturing companies.

The Home Railway market is distinguished by substantial rises in the shares of the Underground Electric Railways of London. The £10 shares at 3¼ are 5s. higher, and the "A" shares rose to 10s. 6d. Even for the Contingent Certificates a small demand arose on the basis of 5d. per certificate. The company is publishing good traffics, and the rise in prices is ascribed to the expectation of a small dividend being declared in the near future on the £10 shares. Districts, after touching 57, eased off to 56½, at which price they still show a point rise on the week, while Metropolitans, which rose to 83, came back again to 82, at which they stood in our last tables.

London transport issues, apart from the Railway stocks, are heavy. London United Tramways debenture is lower at 51½. London & Suburban preference shares are weak at 6s. 6d. British Electric Tractions hold their prices. Mexican Utilities are unable to progress. The Tramways 6 per cent. bonds have receded to 55. British Columbia stocks continue their buoyant tendency, and part of the recent dividend deductions has been regained.

The weekly figures relating to the stocks of raw rubber on hand show a moderate increase of supply, after nearly six months of uninterrupted decline. This has led to profit-taking upon shares that have lately been active in the market. Prices went back a trifle, and there followed the usual falling-off in business. Iron, steel and "Armament" shares are better, as indicated above. The cheerfulness with which Stock Exchange markets opened the New Year is still apparent in most departments, but the volume of buying exhibits a diminution as compared with that of the past few weeks.

Share List of Electrical Companies

HOME ELECTRICITY COMPANIES.

	Nom. £	Dividend. 1923.	Dividend. 1923.	Price Jan. 12, 1924.	Rise or fall.	Yield. £ s. d.
Brompton Ordinary	1	12	10	1⅞	—	*£5 6 8
Charing Cross Ordinary	1	14	14½	2 5/16	+ 1/16	6 5 0
do. do. do. 4½ Pref.	1	4½	4½	17/6	—	5 3 6
Chelsea	1	10	12	37/6	—	6 6 0
City of London	1	15	15	42/9	+1/3	6 9 0
do. do. 6 % Pref. ...	1	6	6	23/6	—	5 5 0
County of London	1	10	15	52/6	—	5 14 3
do. do. 6 % Pref. ...	1	6	6	23/6	—	5 5 0
Edmundson's Ordinary	1	7	7	22/-	—	... ...
do. 7 % Pref.	1	6	6	24/- xd	—	5 6 1
Kensington Ordinary	5	12	14	10½	—	6 13 0
London Electric	1	10	10	35/-	+1/6	5 14 3
do. do. 6 % Pref. ...	5	6	6	6⅝	+ ⅛	5 9 1
Metropolitan	1	8½	10	1⅞	—	5 6 0
do. 4½ % Pref.	1	4½	4½	17/6	—	5 3 6
Newcastle-on-Tyne Ordinary ...	1	2½	5	1½	— 1/16	6 6 0
do. 5 % Pref. ...	1	5	5	18/9	—	5 6 0
do. 7 % Pref. ...	1	7	7	25/-	—	5 12 0
Notting Hill 6 % Pref.	10	6	6	9½	—	6 6 1
North Met. Elec. 6 % Pref. ...	1	6	6	1⅛	—	5 6 1
Urban Ordinary	1	—	4	12/6	—	6 8 0
do 6 % Pref. ...	1	5	6	19/6	—	6 3 1
St. James' and Pall Mall ...	5	14½	17½	12⅝	—	6 18 0
South London	1	11	15	2½	—	6 13 6
South Metropolitan Pref. ...	...	7	7	1½	—	6 13 0
Westminster Ordinary	5	12	15	11½	+ ½	6 13 0
Whitehall Elec. Invst. 7½ % Pref.	1	7½	7½	1	+6d.	7 10 0

HOME RAILS.

Central London Ord. Assented	Stock	4	4	7⅛	—	5 12 1
Metropolitan	,,	3½	4	8½	—	4 17 0
do. District	,,	3	3½	56½	+1	6 4 0
Underground Electric Ordinary	10	Nil	Nil	3½	+ ½	Nil
do. do. "A" ...	1	Nil	Nil	10/6	+1/-	Nil
do. do. Income Bonds	5	6		100	—	*5 0 0

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	Stock	6	6	105	+ ½	5 14 3
do. Def.	,,	1½	1½	24½	—	6 2 6
Chili Telephone	5	6	6	5⅝xd	—	*5 6 6
Cuba Sub. Ord.	10	7	7	7	—	10 0 0
Eastern Extension...	10	10	10	17xd	+ ½	*5 17 0
Eastern Tel. Ord.	Stock	10	10	17½xd	+2½	*5 14 0
Globe Tel. and T. Ord.	10	10	10	17½	—	*5 14 0
do. do. Pref.	10	6	6	11½	—	5 9 0
Great Northern Tel.	10	24	29	29½	—	7 0 0
Indo-European	25	7	7	23½	—	*5 0 0
Marconi	1	15	10	1 1/16	+ 1/16	5 13 6
Oriental Telephone Ord.... ...	1	12	12	1⅞	—	*6 8 0
United R. Plate Tel.	5	8	8	6½	—	*5 15 0
Western Telegraph		10	10	17	—	5 17 0

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref. ...	5	12½	5½	8 1/16	—	6 13 0
do. do. 2nd Pref. ...	5	5½	6	2⅝	—	10 5 0
do. do. 5% Deb. ...	Stock	5	5	15½	—	6 13 0
British Electric Traction Ord. ...	,,	5	5	9½	—	5 0 0
do. do 6% Pref.	,,	6	6	105½	—	5 13 0
Brazil Traction	100	4	4	58	—	5 13 0
Brit. Columbia Elec. Rly. Pcs.	Stock	5	5	87½xd	—	5 13 0
do. do. Preferred	,,	5	95/-	88½xd	—1	*5 5 0
do. do. Deferred	,,	5	129/5	111½	—2	*5 15 0
do. do. Deb.	,,	4½	4½	81½	+1	5 4 4
Lond. & Sub. Trac. 5 % Pref. ...	1	5	2½	6/8	—	7 10 0
London United Tram. Deb. ...	Stock	4	4	51½	—1	7 15 4
Mexico Trams. 5% Bonds ...	—	Nil	5	71	—	7 0 0
do 6% Bonds ...	—	Nil	Nil	55	—1	Nil
Mexican Light Common ...	100	Nil	Nil	24	—	Nil
do. Pref.	100	Nil	Nil	52½	—	Nil
do. 1st Bonds ...	—	5	5	66	—	7 11 6

MANUFACTURING COMPANIES.

Babcock & Wilcox... ...	1	20	12	55/-	+2/-	*4 5 0
British Aluminium Ord.... ...	1	5	5	33/9	+1/6	2 19 4
British Insulated Ord. ...	1	15	15	3	—	5 0 0
Callenders	1	15	15	3 1/16	+ ⅛	4 17 0
do. 6½ Pref.... ...	1	6½	6½	23/9	—	5 9 0
Crompton Ord.	1	5	Nil	⅜	+ ⅛	... ...
Edison-Swan	4/-	7½	10	6/3	+6d.	6 8 0
,, 6% Deb.	Stock	5	5	81½	—	6 0 3
Electric Construction	1	10	10	1⅞	+ ⅛	5 14 3
English Electric	1	5	5	20/3	+1/-	4 19 7
do. do. Pref.	1	6	6	21/3	+6d.	5 11 7
Gen. Elec. Pref.	1	6½	6½	23/3	—	5 11 10
do. Ord.	1	5	5	23/9	+2/3	4 4 5
Henley	1	15	15	3	—	5 0 0
do. 4½ Pref.	5	4½	4½	4⅛	—	5 9 0
India-Rubber	1	10	5	17/6	—	*5 14 3
Met.-Vickers Pref....	2	8	8	2½	—	6 8 0
Siemens Ord.	1	5	—	24/3	—	4 2 6
Telegraph Construction	12	20	20	26½	—	*4 10 6

*Dividends paid free of Income Tax.

Boiler-Room Practice.

Balancing Boiler-Room Heat.

By JOHN BRUCE, A.M.I.E.E.

(*Continued from page 72.*)

In the larger generating stations where some sort of system for continuous boiler plant testing is instituted, the information available for the purpose of constructing a heat balance report, will depend entirely upon the extent of the instrument equipment.

The various steps in the computation of a detailed heat balance report are best illustrated by an example, and for this purpose we will assume that the following data represent the principal information and primary deductions obtained from the operating statistics of the boiler plant of a large generating station. For official acceptance tests, many more data are necessary than are reported below, but for our present purpose, *i.e.*, the construction of a heat balance statement, the items given are all that are required. It may, in certain cases, not be possible to set out a heat report so fully detailed as in the example about to be given, especially as regards the heat loss in the dry flue gases, since the calculation of that item necessitates a knowledge of the average composition of the flue gases. In such instances some sort of compromise has to be made.

OPERATING STATISTICS OF BOILER PLANT.

Average boiler steam pressure	275 lb. per sq. in., g.
Average total steam temperature	700 deg. F.
Average degrees superheat	286 ,, ,,
Actual evaporation (lb. water per lb. coal) ...	6.7 lb.
Equivalent evaporation from and at 212 deg. F.	8.51 ,,
Equivalent evaporation from and at 212 deg. F. per 10,000 B.th.u.	8.1 ,,
Average temp. of water entering economiser	160 deg. F.
Average temp. of water leaving economiser	275 ,, ,,
Average temp. rise of water	115 ,, ,,
Average temp. air entering grates	70 ,, ,,
Average temp. gases at economiser intake ...	600 ,, ,,
Average temp. gases at economiser outlet ...	380 ,, ,,
Average temp. drop of gases	220 ,, ,,
Analysis of flue gases :—	
Average CO_2 content, per cent.	13.0
Average O_2 content, per cent.	6.2
Average CO content, per cent.	0.2
Average N_2, &c., content, per cent.	80.6
Analysis of coal as fired :—	
Carbon, per cent.	70.0
Hydrogen, per cent.	4.5
Sulphur, per cent.	1.0
Absolute ash, per cent.	13.5
Moisture, per cent.	11.0

Calorific value of coal as fired, gross B.th.u./lb., 10,500.
Unconsumed carbon in ash, per cent., 15.00.

The first step in the tabulation of the heat account is the computation of the amount of heat transferred to the boiler water and steam, usually expressed in terms of B.th.u., and also as a percentage of the total potential heat in one lb. of the coal as fired. In the following calculations the steam heat quantities involved have been taken from Marks and Davis's latest steam tables. The heat transmited in the boiler, expressed in B.th.u. per lb. of coal,

$$= E \times \{H - (h_1 - 32)\}$$

where E = actual evaporation = 6.7
H = total heat in saturated steam
= 1,204 B.th.u. per lb.
h_1 = temperature of economiser outlet water
= 275 deg. F.

Substituting:—

$$\text{B.th.u.} = 6.7 \times \{1,204 - (275 - 32)\}$$
$$= 6,438 \text{ B.th.u.}$$

And expressed as a percentage of the total heat in the coal:—

$$= \frac{6,438}{C} \times 100 = 61.31 \text{ per cent.}$$

(C = calorific value of coal, B.th.u. per lb.).

The heat transmitted in the superheater, B.th.u. per lb. of coal,

$$= E \times (H_1 - H)$$

where H_1 = total heat per lb. in superheated steam
= 1,361.
(E and H same as in previous equation.)

Substituting:—

$$\text{B.th.u.} = 6.7 \times (1,361 - 1,204)$$
$$= 1,052 \text{ B.th.u.}$$

And expressed as a percentage:—

$$= \frac{1,052}{C} \times 100$$
$$= 10.02 \text{ per cent.}$$

The heat transmitted in the economiser, B.th.u. per lb. of coal,

$$= E \times (h_1 - h)$$

where h = temp. of economiser inlet water
= 160 deg. F.
(E and h_1, same as before).

Substituting:—

$$\text{B.th.u.} = 6.7 \times (275 - 160)$$
$$= 770 \text{ B.th.u.}$$

And expressed as a percentage:—

$$= \frac{770}{C} \times 100$$
$$= 7.33 \text{ per cent.}$$

Adding together these heat quantities we have the total heat transmitted to water and steam in the complete boiler plant:—

$$6,438 + 1,052 + 770.$$

Total heat transferred = 8,260 B.th.u. per lb. of coal.

This represents the heat transferred in the combined equipment of boiler, superheater, and economiser per lb. of coal consumed, and the combined efficiency will therefore be:—

$$61.31 + 10.02 + 7.33$$
$$= 78.66 \text{ per cent.}$$

or per cent. efficiency.

$$= \frac{8,260}{10,500} \times 100 = 78.66 \text{ per cent.}$$

This value could, of course, have been more quickly and simply arrived at from the value of the equivalent evaporation from and at 212 deg. F. per 10,000 B.th.u. in the coal, *e.g.*:—

$$\text{Per cent. efficiency} = \frac{8.1 \times 970.4}{10,000} \times 100$$
$$= 78.6 \text{ per cent.}$$

Where possible, however, it is better to take out each value separately so that the performance of each component of the equipment can be accurately determined and fairly judged. Remark was made concerning the use of charts or graphs for facilitating the determination of boiler plant efficiencies and losses. In fig. 3 is shown a chart from which the boiler plant or boiler unit overall efficiency can be quickly estimated. The preparation of such a chart, covering the range of variables for a particular plant, presents very little difficulty, and consists of plotting the variables in the boiler efficiency equation on a common graph field. It is extremely simple to read, and provided the scale adopted will permit, and the calculations involved in plotting the curves are fairly accurate, it will give results correct to at least the first decimal.

For example, assume the total heat per lb. of steam produced to be 1,240 B.th.u. per lb. above heat in inlet feed water, actual evaporation 6.6 lb. of water per lb. of coal consumed, calorific value of coal 10,500

B.th.u. per lb. as fired. The 1,240 vertical is dropped to where it cuts the 6.6 evaporation line, a horizontal is taken from this point to where it cuts the calorific value line 10,500, and a vertical dropped from here cuts the base at the boiler unit or plant efficiency, which for the assumed example is 77.9 per cent.

It was pointed out in a previous article that the determination of only the efficiency of a boiler plant conveys very little direct information as to the cost of producing steam, which, after all, is the point of most importance, for the maximum point in the efficiency curve does not necessarily represent the point of maximum economy, especially if the turbine room performance is taken into consideration as well. The scope of this article, however, is limited to the boiler room. In a modern well-equipped plant where daily, or possibly shift to shift, calorific value determinations are made, a set of useful curves can be plotted from which the cost of evaporating a definite quantity of water can be readily estimated. For purposes of comparison, it is advisable to refer the evaporation values to a comparable base, *e.g.*, either evaporation from and at 212 deg. F., or evaporation from and at 212 deg. F. per 10,000 B.th.u. in coal. Fig. 4 shows an example of such a series of curves, their construction and method of use being practically self-explanatory from the diagram.

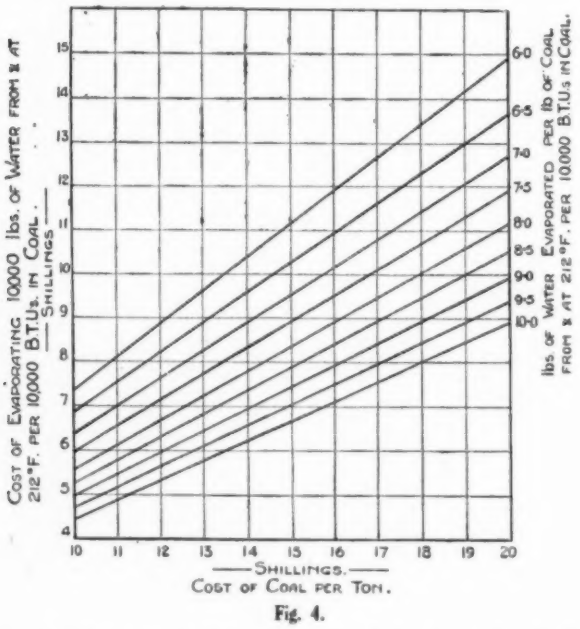

Cost of Evaporating 10000 lbs. of Water from & at 212°F. per 10,000 B.T.Us. in Coal.
—Shillings.—
lbs. of Water Evaporated per lb. of Coal from & at 212°F. per 10,000 B.T.Us in Coal.
—Shillings.—
Cost of Coal per Ton.

Fig. 4.

Coming now to the estimation of the losses involved for the heat balance under construction, it is by the systematic tabulation, apportioning and analysis of the separate losses that opportunities are presented, which, if correctly made use of, will result in increased economy in boiler-room operation.

Taking first the loss due to heat carried away in the dry flue gases, which, as we have seen, represents the greatest loss incurred, this loss, expressed in terms of B.th.u. per lb. of coal consumed, is calculated from the formula:—

$$\text{B.th.u.} = .24\ w\ (T - t).$$

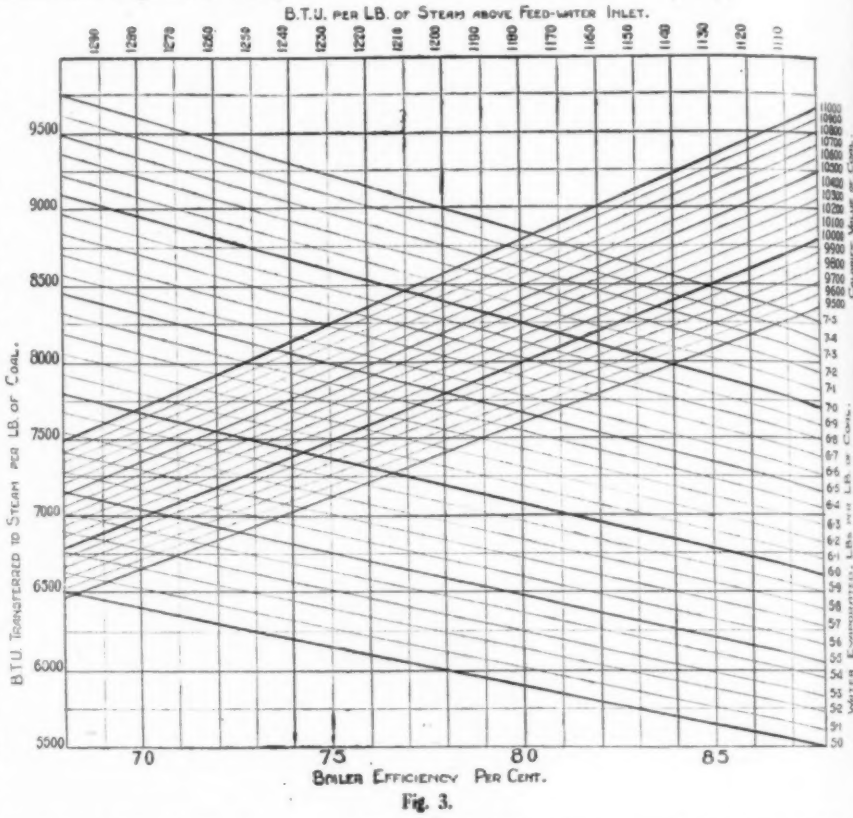


Fig. 3.

The weight of dry gas produced per lb. of coal is calculated as follows, and it is in the determination of this item that so many of the formulæ offered for combustion calculations give inaccurate results. The weight of dry gas produced per lb. of carbon would be:—

$$\frac{(11 \times 13.0) + (8 \times 6.2) + \{7 \times (80.6 + 0.2)\}}{3 \times (13.0 + 0.2)}$$

$$= 19.41 \text{ lb. of gas produced per lb. of carbon.}$$

The weight of carbon per lb. of coal as fired is 0.70 lb., but as certain of this carbon has been carried over in the ash in an unconsumed condition, the carbon weight in the coal determined by analysis must be corrected for unconsumed carbon before the dry gas weight per lb. of coal can be calculated. Expressed in terms of total carbon, the weight of unconsumed carbon in the ash discharged is 0.02 lb. per lb., and the weight of carbon consumed and appearing in the dry flue gases is:—

$$0.70 - 0.02 = 0.68 \text{ lb.},$$

and the weight of the dry flue gases produced per lb. of coal is then:—

$$19.41 \times 0.68 = 13.20 \text{ lb.}$$

The loss in the dry flue gases, expressed in terms of B.th.u. per lb. of coal,

$$= .24 \times 13.2 \times 330$$
$$= 1{,}045 \text{ B.th.u.}$$

and expressed as a percentage of the total heat per lb. of coal

$$= \frac{1{,}045}{10{,}500} \times 100 = 9.95 \text{ per cent.}$$

(To be concluded.)

Proposed Rumanian Cable Factory.—It is reported in the German newspapers that the Banca Rumancasca proposes to erect a cable factory in Chronstadt, and for this purpose has entered into connection with foreign firms, including the Berlin A.E.G. and Siemens & Halske. If established, the factory would be the first of its kind in Rumania.

The Physical Society of London.

Annual Exhibition of Instruments.

THE Physical Society of London and the Optical Society held their exhibition of electrical, optical, and other physical apparatus at the Imperial College of Science as usual on January 7th and 8th. The show was the fifteenth of the annual series, and the number of exhibitors was slightly greater than last year's figure, a large collection of scientific apparatus and instruments being displayed by some 56 firms, the majority being electrical. As is customary, many demonstrations had been arranged, and discourses were given by Mr. F. Twyman, F.R.S., on "Some Experiments with Interferometers," and Mr. C. F. Elwell, B.A., M.I.E.E., on "Talking Motion Pictures."* New products were displayed by several firms, and as a whole the exhibition reflected the progress made by British manufacturers during the past year. Noticeable features were the excellence of design and the high standard of workmanship and finish of the instruments.

Siemens Bros. & Co., Ltd.

On this stand was noticed a temperature indicator, fairly recently placed on the market, that enables the temperature of any cable, buried or not, and the rise due to overload to be observed or, if desired, continuously recorded. The loading limit can thus be accurately determined. The principle of the Siemens indicator is based on the change in resistance of special pilot wires in the cable which is caused by the increase in temperature. The pilot wires are connected to a Wheatstone bridge, fig. 1, and any change in their resistance is shown on the moving-coil indicator connected across the bridge.

The pilots are usually of nickel and are inserted as a pair of small pilot cores, connected in series so as to form a loop. In a multi-core l.p. cable they may take the place of the

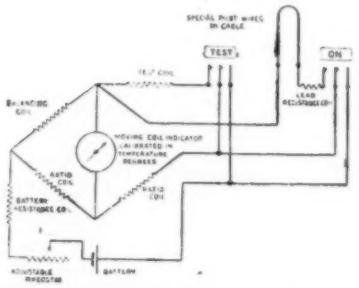


Fig. 1.—Siemens Cable Temperature Indicator. Diagram of Connections.

warming in the centre of the cable and in an e.h.p. feeder, where any core in the centre of the cable would require to be fully insulated, they may be introduced near the lead sheath from which they only need be lightly insulated. In this case, the actual temperature of the pilot cores would be rather lower than that of the surface of the main conductors (i.e., the hottest point of the insulation), but this can be allowed for, if desired, in the calibration of the instrument. The indicator is identical in appearance with an ordinary volt-

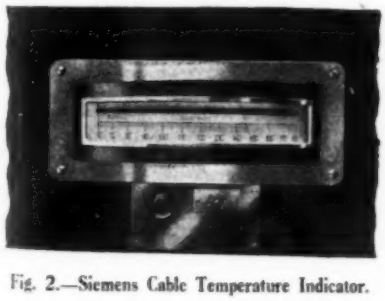


Fig. 2.—Siemens Cable Temperature Indicator.

meter, excepting that the scale is calibrated in temperature degrees instead of volts; fig. 2 shows the type of instrument most generally used; it is arranged for flush fitting on a switchboard panel and has a 10-in. scale. If desired, however, other types can be supplied.

* ELECTRICAL REVIEW, December 26th, 1924.

The bridge coils, rheostat, &c., are generally fitted on the back of a small panel below the indicator (see fig. 2). Variations in battery voltage which would affect the accuracy of the readings are compensated by means of an adjustable rheostat and test switch. To obtain the temperature of the cable, the lever switch is moved to the "on" position, when the temperature can be read directly on the scale. It is a simple matter to connect several cables to the same indicator by means of additional lever switches, and temperature readings of all the cables can then be taken successively in a few moments. The battery usually consists of one dry cell.

If a permanent record of temperature is required a recorder, type M.V.R.A., can be used; it has a continuous paper chart which will last for two months without replacement and is driven by an 8-day clockwork mechanism. If desired, it can be supplied with a 4-colour recording mechanism, actuated by a 4-volt accumulator, which will show the temperature of four different cables on the same chart in different coloured

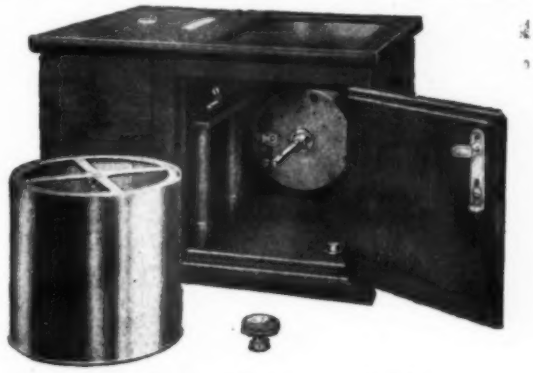


Fig. 3.—Siemens Cable Temperature Recorder.

inks. The chart speed is 20 mm. ($\frac{3}{4}$ in. per hour), and the useful width of chart is 120 mm. ($4\frac{3}{4}$ in.). Type M.V.R.G. recorder, fig. 3, is a simpler but cheaper form, in which the chart is a 24-hour one on a rotating drum. The pilot wires are connected to the indicating (or recording) outfit by ordinary twin copper cable. Variations in the resistance of this cable due to atmospheric temperature variations will affect the indicator readings, but this error may easily be reduced to a negligible quantity by using a suitable size of conductor.

Other exhibits on this stand were a thermo-electric potentiometer for measuring the electromotive force of thermo-couples. An optical pyrometer, designed for measuring very high temperatures, *i.e.*, above 600 deg. C., when it is impracticable to employ thermo-electrical pyrometers. A water pyrometer, with which measurements may be made up to 1,200 deg. C., with an accuracy of about 10 deg. C., and an electrical distance thermometer for temperatures of from − 200 to 500 deg. C.

Cambridge Instrument Co., Ltd.

The exhibits of this company were as numerous as ever, amongst them being the photo-electric cell illustrated in fig. 4, which is designed to facilitate the accurate measurement of light intensities. It comprises a glass vessel having silvered

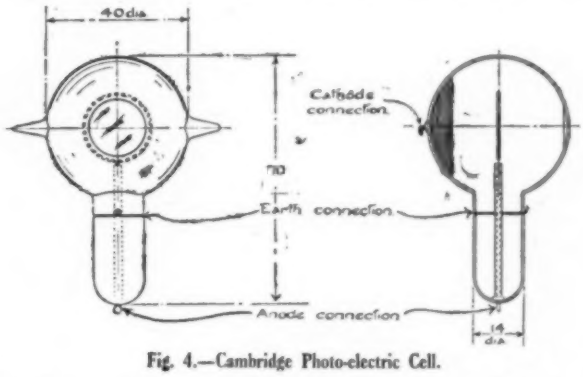


Fig. 4.—Cambridge Photo-electric Cell.

walls, upon which a metal—such as potassium or helium—is deposited in a sensitive colloidal form. When light falls upon this metal deposit, electrons are emitted and are caught on a ring-shaped anode; the resulting current is proportional to the intensity of the incident light. This current can be amplified by using an accelerating potential, which causes

ionisation by collision in the rare gas with which the cell is filled at an appropriate pressure. In the cell that was exhibited the metal used was potassium and the cell was filled with helium, giving a current of the order of 10^{-9} ampere for 1 metre candle. The most convenient way of comparing currents of this order of magnitude is to measure with an electrometer the potential reached when the electric charge leaks to earth through a high resistance. The electrometer shown with the cell was designed by Prof. F. A. Lindemann for use in this connection. It is compact and robust, has a high sensitivity, a stable zero, and does not require levelling; the capacity is less than two centimetres. A calibration curve—giving the current produced by standard illumination with various accelerating potentials—is supplied with each cell; a curve for a normal cell is shown in fig. 5. For a given wavelength distribution the ratio of current to illumination is constant within the limits of experimental error. If the intensity of the incident light is stronger, and the current correspondingly greater, an ordinary galvanometer can be employed.

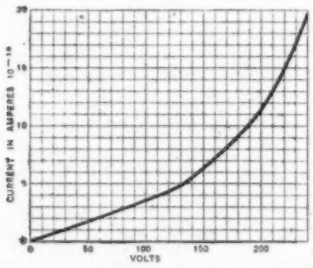


Fig. 5.—Normal Cell Calibration Curve.

The fixed and variable air condensers that were shown differ from previous models inasmuch as the insulators consist of glass balls located definitely in position between the plates by the Kelvin hole, slot, and plane device. This modification, which is due to Mr. W. H. Lawes, eliminates errors due to the flowing of semi-plastic materials, such as ebonite, and due to variations in the temperature of these materials; it prevents the gradual increase of power factor after some months of use, due to increased surface leakage, and small irregular changes in capacity due to mechanical distortion.

Modified forms of the original Zamboni battery, which have been developed by Major C. E. S. Phillips, consist of a number of disks placed one above the other and suitably mounted. The disks are of paper, coated on either side with metal foil; each disk gives approximately half a volt. One pattern, which has been designed for use in connection with ionisation chambers, has disks 130 mm. in diameter, the number used depending on the potential required; the standard battery gives a potential difference of 500 volts. The second pattern (having disks 15 mm. in diameter) has been designed for charging electroscopes, and is particularly suitable for use in radioactive work. Both models are easily portable and convenient to use; they are in no way damaged by being short-circuited and, if set aside, rapidly recover their normal potential. They have a low temperature coefficient.

A 6-dial low-induction resistance box shown was designed for use in connection with alternating-current measurements, the forms of winding, due to Campbell (and, independently, to Grover and Curtis) being such that inductance and capacity effects are practically eliminated. The instrument is compact and it includes five decade dial resistance coils, having total resistances of 1, 10, 100, 1,000 and 10,000 ohms respectively, together with a rheostat (also controlled by a dial switch) which enables a fine adjustment to be made. The box is suitable for frequencies up to 2,000 per second, and the resistances are adjusted to an accuracy of 0.02 per cent. at the higher values.

The frequency meter shown in fig. 6 has been recently designed by Mr. Albert Campbell for the accurate measurement of audio frequencies of from 200 to 4,000 cycles; it is of particular value in telephone work and depends for its operation upon the action of two mutual inductances, the secondaries of which form a closed circuit having a definite resistance for one range. The resistances in this circuit are suitably connected to studs, over which a switch can be moved to change the range; five ranges are provided, covering frequencies from about 180 to 400, 300 to 650, 600 to 1,300, 1,300 to 2,600, and 1,800 to 4,000 cycles per second respectively. The balance is obtained by moving one of the inductances; the head controlling this movement is attached to a pointer which moves over a calibrated scale. The condition of balance is indicated by silence in the telephone and the frequency of the circuit under test is then found by multiplying the reading on the scale by a simple factor (0.3, 0.5, 1, 2, or 3), depending upon the particular range used. The accuracy of adjustment is to 0.1 part in 1,000, representing a distance of 0.5 mm. on the scale. On each of the two lower ranges provision is made for correcting small errors due to the temperature of the instrument; on the other ranges the temperature coefficient is negligible. The instrument is portable and convenient to use.

The thermionic voltmeter designed by Mr. E. B. Moullin for the measurement of small voltages at high or low frequency possesses the unique feature of absorbing no power from the circuit under test. The readings are unaffected by frequency and the capacity is negligible. The action of the instrument depends on the rectifying property of a triode valve. Pattern A employs the curvature of the anode current-grid potential characteristic, dispensing with the need for a separate anode battery. The valve, together with a sensitive "Unipivot" voltmeter (range 0-1.5 volts) and auxiliary apparatus, is mounted in a case with terminals for connecting to a 6-volt battery and to the electromotive force to be measured. Readings can be obtained to 0.02 volt and the only variable factor in the instrument is the filament battery, and the conditions at the time of calibration may readily be reproduced by adjusting the filament circuit, which operates as a zero adjustment. When using this pattern the apparatus connected across the voltage terminals must form part of a closed circuit. Pattern B (fig. 7) is constructed on a similar principle, but requires an anode battery. It can be employed for measurements where there are no conducting circuits between the voltage terminals of the circuit, and also to measure an a.c. potential superposed on a steady d.c. potential. The standard range is 0 to 5 volts; direct readings are obtainable to 0.5 volt and the construction is such that the conditions obtaining at the time of calibration can be reproduced, and the galvanometer can be used to measure the voltage of the battery.

In connection with certain applications in brewing, tanning, and similar industrial processes, it is an advantage to have a continuous record of hydrogen-ion concentration (P), and the outfit developed for this purpose can also be usefully employed in connection with the determination of the acidity of boiler feed water. The outfit exhibited consisted of a high-resistance thread recorder together with two benzo-quinhydrone electrodes, one containing a standard P$_H$ solution. The recorder is arranged to measure potentials up to about 0.6 volt to an accuracy of from 10 to 20 millivolts. The electromotive force generated is a direct linear function of the P$_H$ value of the solution.

The vibrograph is a form of seismograph designed for the accurate measurement of vertical vibration in roads, bridges, and other structures. Its essential feature is the mechanical method of recording due to Mr. W. G. Collins, which secures diagrams on transparent celluloid film by the action of a moving stylus. The same method is also used in the recording accelerometer, fig. 8, which has ben designed for measuring

Fig. 6.—Campbell Frequency Meter.

Fig. 7.—Moullin Thermionic Voltmeter.

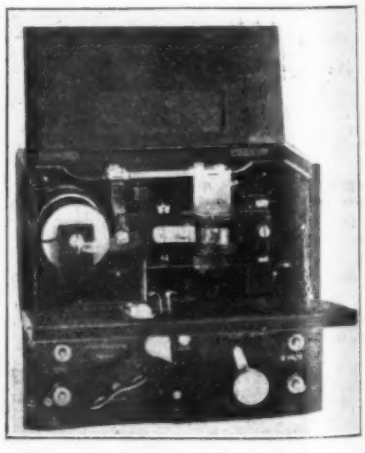


Fig. 8.—Cambridge Recording Accelerometer

the acceleration of railway coaches, lifts, &c.; it provides a convenient means of studying the springing of vehicles and the effect produced on them by various road surfaces and can be used to compare the "comfort" of different types of tires when fitted to motor-cars. The instrument, when placed for recording vertical accelerations has a mass supported by two flat steel strips and is connected by means of another steel strip to a member, moving on knife-edges, which carries a flat strip of aluminium, to which the stylus is attached. The eddy currents set up by the movement of the aluminium strip between the poles of the electromagnet powerfully damp the movement and render the instrument almost critically damped.

(To be continued.)

The Domestic Electrical Load.

I.E.E. SCOTTISH CENTRE: CHAIRMAN'S ADDRESS.—*Abstract.*

MR. ALEXANDER LINDSAY, M.I.E.E., delivered his inaugural address as chairman of the Scottish Centre of the Institution of Electrical Engineers at Glasgow on November 11th, 1924. Following some general remarks he referred more particularly to a matter of topical interest—the cultivation of, and distribution for, the domestic load—pointing out, *inter alia*, that not only is there a heating and cooking load to be worked up, but an even greater lighting load absolutely untouched, awaiting development. More than eight million houses in Britain are without electric light, equivalent to an annual load valued at £49,000,000, and each house when once supplied with electricity is a potential user of heating and cooking gear as well as light. There appear to be several reasons why the results so far obtained have been so meagre, compared with the energy expended in advertising, canvassing, and demonstrating:

Installation Costs.—In a city such as Glasgow, where the great majority of the possible users are resident only in rented premises, the cost of an installation assumes an importance altogether out of proportion to its intrinsic importance. Costs which may be quite reasonable in themselves assume an entirely different aspect when looked at from the point of view of a tenant with uncertain tenancy. The introduction of electric lighting into any premises enhances their value, and it seems unreasonable that the outgoing tenant should not be recompensed by the proprietor for such an obvious improvement. If the tenant farmer finds it necessary to build a dyke round his piggery he can claim against his landlord for this improvement, while for a similar case the city dweller may not—either an injustice to the latter or a gratuitous pampering of the former.

The scheme recently introduced by Glasgow Corporation, whereby the proprietors and tenants (with the backing of the Electricity Department) share in the cost of installation, appears to be a step in the right direction. Here, the proprietor pays for the main cabling, whilst the tenant pays by instalments for the wiring of his own house. It is manifestly unfair to ask the tenant on the third floor of a tenement to pay for mains from the street-level; that is the proprietor's duty, and his alone. The author is of the opinion that the proprietor should also pay a proportion of the cost of the internal wiring. He gets that extra value added to his property and there is no reason why a property owner should receive presents of this nature. The Glasgow scheme has now been in operation over three months, and the results to date have been sufficient to warrant confidence in its success.

Cost of Apparatus.—From the very nature of electrical appliances, compared with gas cookers and heaters, there must be a great difference in first cost, and it is our duty frankly to acknowledge such a basic fact. Our contention should be that the convenience, comfort, cleanliness, economy and safety of the electrical apparatus so far exceed those of the rival gear that the extra expenditure is fully warranted and will be repaid with interest during the useful life of the appliances. The cost of good-quality gear is steadily decreasing. The hiring scheme in Glasgow has been a great success and has exceeded all expectations. There are now approximately 1,100 electric cookers and 3,500 radiators let out on hire to consumers on the system.

Cost of Energy.—The cost of distribution is still too high, being much in excess of the cost of generation, and supply engineers will have to concentrate their efforts in effecting reductions in this direction.

No supply undertaking is, however, capable of controlling the manner in which the energy is used by the consumer. This is where the contractor can do a lot of useful work. By planning an educational campaign for the benefit of his clients, by instructing them as to the most economical lamps and apparatus to use and how to get the best results at the least expenditure, their bills will be reduced, with the ultimate result that the same people who now grumble at their electricity bills will install more consuming devices, because they will realise that they are getting efficient apparatus and good value for their money.

The cost of energy to the consumer is not merely the rate per kWh charged by the supply undertaking, but is also the cost to him of inefficient apparatus and faulty use. It would pay both the suppliers and the contractors to reduce this cost as far as possible, for a satisfied customer is the very best advertisement which it is possible to have.

System of Charging.—There is now a decided tendency to leave mathematical methods severely alone and give a simple straightforward tariff. For domestic supply, while the maximum-demand tariff is still used by both the large supply authorities in the Glasgow area, they have an alternative rental method which involves a (1) fixed annual charge and (2) flat rate per kWh as recorded on the meter. In one instance, for example, the fixed annual charge is based on the size of the house, being 20s. per room; and in another the fixed charge is equal to approximately one-eighth of the house rent. The flat rates vary from ¾d. to ¼d. per kWh recorded on the meter.

A comparison of two typical residential areas shows that where the maximum-demand tariff is in operation the average price per kWh is 3.1d. and the average income per consumer is £6 1s. 6d., whilst where the rental tariff is in use the average rate per kWh is only 1.39d., but the income per consumer is on the average about £14. Many consumers who use electricity for cooking and heating throughout get their supply for much less than this figure, the rate per kWh in some cases falling as low as 0.915d. Figures such as these would suggest that a simple understandable method of charging will assist in raising the domestic demand to a much higher level than the station engineer has yet conceived. This new era will not arrive, however, unless we work for it.

As a contractor, the author addresses a few words especially to the contractor members of the I.E.E. The association between the contractors and the Institution should be closer than it is at present. The Institution is democratic, and as such welcomes the contractor as a member, and he should take his place and make his presence and interest felt. For many reasons the Institution is well worthy of all the support the contractors can give it. The national scheme of registration is attracting the contractor in increasing numbers and is undoubtedly raising his status. The Institution wiring rules are good for the community and for the contractor. Some are inclined to suggest that we have too many regulations and laws, but just as the honest man can walk without fear of the law so the honest contractor has no quarrel with regulations designed for the good of the industry. For these reasons alone, the contractor should support the Institution to the utmost.

We all look forward to the time when electric cookers, radiators, vacuum cleaners, and so on will be as plentiful and commonplace as autumn leaves in the forest. If we do not set the example ourselves, how can we expect others to do what we merely advise?

Electricity Supply at Aylesbury.

A Proposed Extension Scheme.

ON December 8th, 1924, the Aylesbury Town Council, after a strenuous debate, agreed to adopt the report of its consulting engineer, Mr. W. M. Selvey, M.I.E.E., relative to the extension of the borough's supply of electricity beyond the confines of the town boundaries. All members of Council were present and 13 voted in favour of the project, six against, and five refrained from voting. Application is being made to the Electricity Commissioners for a Special Order to carry out the scheme.

The consulting engineer's report, which largely confirms the original proposals of the Corporation's electrical engineer, Mr. W. A. Turnbull, A.M.Inst.C.E., A.M.I.E.E., recommends that the area to be supplied should include the whole of the rural districts of Aylesbury and Long Crendon; parts of the rural districts of Wycombe, Thame, and Berkhamsted; and the urban districts of Tring and Thame. The scheme would be delayed by the negotiation necessary to include Buckingham, since an unauthorised undertaking already exists there; it may, however, subsequently come into the scheme. It is also recommended that consideration of the case of Bicester be deferred, as the local authority at present favours a scheme of its own.

Mr. Selvey recommends a mixed system of high-pressure overhead and underground mains, and finds the line adopted by Mr. Turnbull for supplying Waddeson suitable for adoption as a standard. Direct mains to Tring, Wendover, and Thame should be proceeded with on the scheme receiving sanction; an extension of the main to two branches in the Tring district and also to Chinner in the second stage, followed by a third stage in which the main would be continued through Princes Risborough *via* the Chequers district to Wendover and on *via* Dancer's Lane pumping station to Tring.

This will form a double ring-main system which should suffice to deal with all the needs of the district for many years. Subsidiary branch lines will be necessary and substantial distribution systems are provided for; also the e.h.p. lines can be tapped at places to supply groups of consumers from lower-pressure distribution lines. Finally, it will be simple to close the link from Princes Risborough to Wendover.

The transmission pressure would be the same as that of the Waddeson line, *viz.*, 11,000 volts, the line being so designed that by changing the insulators alone it can be made suitable for 33,000 volts; the need for the higher pressure is, however, remote. The rating for each of the three main radial feeders for a moderate voltage drop is 500 kW. The length of the e.h.p. lines for the first stage is 21¼ miles, for the second 7¼ miles, and for the closing links 13 miles, or a total of 42¼ miles. The distribution mains would be underground in main streets and overhead in scattered areas; their mileage would be 12¼ for the first stage and 3¼ for the second, a total of 15½ miles, and the voltage might well be the same as in Aylesbury town, *i.e.*, 380/220 V. It is expected that the distribution system allowed for in the first stage estimates would be completed in two years' time, and a substantial portion of it should be in operation by the end of the first year of construction.

The capital expenditure proposed is shown in the accompanying table.

Line Section.	1st Stage. £	2nd Stage. £	Totals. £
Aylesbury to Tring	10,958	2,519	13,477
Aylesbury to Wendover ...	9,804	1,171	10,975
Aylesbury to Thame ...	11,819	5,885	17,704
Totals ...	£32,581	£9,576	£42,156

The closing link from Chinner to Tring *via* Princes Risborough and Wendover would cost £10,923, making the grand total £53,079. The immediate expenditure recommended is that on the e.h.p. lines in the three sections, which are estimated to cost £20,153, and *pari passu* with this (but spread over two years) £12,428 for distribution, giving the first stage total of £32,581.

The balance between expenditure and revenue is very close. With a total revenue of £5,287 there is only sufficient margin to put aside £417 for general expenses and £240 for special expenditure. In no sense can the arrangement as to prices made with Tring, and adopted for the present estimates, be described as making a profit in the immediate future; 50 per cent. of the revenue is absorbed in meeting interest and sinking fund charges and, as these will occasion some concern in the first year, the consulting engineer has kept well in mind the various hopes of Government assistance and other facilities that are available.

Nevertheless, should no such assistance be forthcoming, Mr. Selvey would still be prepared to advise the first stage of the scheme being carried out. As regards the second stage, he has no anxiety whatever if certain pumping and power loads are secured.

The demand on the system resulting from the first stage of the extensions, so far as it is calculated to increase the peak load, is only 115.3 kW (kWh sold 197,476); therefore no additional generating plant is required. In the second stage the additional demand is estimated at 439.2 kW (kWh sold 1,639,296) and, if overlapping the peak, would necessitate the consideration of providing further generating plant. If not, and there is reason to think that it can be so arranged, the generating plant would still suffice. Hence the proposals do not call for other expenditure than that estimated above; they will, however, raise the load to such a point that, if any considerable new demand had to be met, a further turbo-generator would become necessary (costing, say, £20,000). This would undoubtedly occur if, in addition to the scheme outlined, the possible load to the North was secured, the consideration of which is at present deferred.

The Aylesbury generating station was described in our issue of September 28th, 1923.

Trade with Canada.—The Senior Trade Commissioner in Canada (Mr. F. W. Field) has forwarded to the Department of Overseas Trade a memorandum on the terms of payment usual in Canada. He states that the terms on which the majority of Canadian buyers endeavour to do business are, as a rule, more extended than British manufacturers desire to recognise. The majority of Canadian importers, in goods handled directly or indirectly through the retailer, seek credit of 30, 60 or 90 days, which is customarily extended by the established American manufacturers. It is difficult, in the face of that condition, for British manufacturers of such goods to insist on "cash against documents," or as some do, "cash before shipment." A knowledge of British currency is not universal in Canada. All that can be done, therefore, to save the Canadian importer the trouble of converting one currency into the other, will materially assist commercial transactions. Catalogues, price lists, advertising cards, or any printed matter designed to attract Canadian buying should be expressed in dollars and cents, and not in British currency. In considering the volume of trade, it must not be overlooked that Canada's population is approximately only 9,000,000, and that there is substantial Canadian industrial production and strong and intimate competition from the United States. A satisfactory arrangement should be made for local representation. Having the best possible man, obviously he should be encouraged to deal with the better firms, collections from which cause no anxiety, rather than to think only of a large volume of trade, with little regard to credit ratings and the inevitable costly results.

The Import Trade of Siam.

THE following figures, showing the imports of electrical and similar goods into the port of Bangkok during the year ended March, 1924, are taken from the recently-issued official trade statistics; the figures for the year ended March, 1923, are included for purposes of comparison, and notes of any increases or decreases are given. Imports stated to be from Singapore and Hong-Kong are for the most part the produce of other countries shipped *viâ* these two ports:—

	1922-23. Ticals.	1923-24. Ticals.	Inc. or Dec. Ticals.
Lamps.—			
Total	300,000	392,000	+ 92,000
From Singapore	66,000	59,000	– 7,000
,, Hong-Kong	23,000	32,000	+ 9,000
,, United Kingdom ...	39,000	62,000	+ 23,000
,, United States ...	19,000	26,000	+ 7,000
,, Japan	84,000	80,000	– 4,000
,, Germany	58,000	78,000	+ 20,000
,, Sweden	—	36,000	+ 36,000
Electrical goods and apparatus.—			
Total	798,000	1,151,100	+ 353,100
From United Kingdom ...	307,000	287,000	– 20,000
,, Germany	87,000	328,000	+ 241,000
,, United States ...	142,000	118,000	– 24,000
,, Singapore	24,000	22,000	– 2,000
,, Sweden	42,000	27,000	– 15,000
,, Italy	16,000	31,000	+ 15,000
,, Holland	47,000	54,000	+ 7,000
,, France	11,000	17,000	+ 6,000
,, Japan	60,000	32,000	– 28,000
Manufactures of copper.—			
Total	58,000	71,000	+ 13,000
From Hong-Kong	6,000	1,000	– 5,000
,, United Kingdom ...	39,000	32,000	– 7,000
,, India	4,000	6,000	+ 2,000
,, Germany	5,000	20,000	+ 15,000
,, France	—	5,000	+ 5,000
Scientific instruments and apparatus.—			
Total	276,000	217,000	– 59,000
From United Kingdom ...	118,000	84,000	– 34,000
,, Germany	28,000	23,000	– 5,000
,, France	5,000	6,000	+ 1,000
,, Japan	28,000	24,000	– 4,000
,, United States ...	16,000	28,000	+ 12,000
,, Denmark	41,000	7,000	– 34,000
,, Belgium	—	10,000	+ 10,000
Prime movers, other than locomotives, marine, military, and agricultural machinery.—			
Total	470,000	321,000	– 149,000
From United Kingdom ...	309,000	129,000	– 180,000
,, United States ...	135,000	132,000	– 3,000
,, Germany	21,000	15,000	– 6,000
,, Denmark	—	28,000	+ 28,000
Machine tools.—			
Total	150,000	142,000	– 8,000
From United Kingdom ...	117,000	89,000	– 28,000
,, United States ...	4,000	1,000	– 3,000
,, Denmark	21,000	7,000	– 14,000
,, Germany	3,000	14,000	+ 11,000
Machinery, unenumerated, including detached parts, and not including agricultural, textile, or sewing machines.—			
Total	779,000	1,291,000	+ 512,000
From United Kingdom ...	443,000	539,000	+ 96,000
,, Japan	5,000	1,000	– 4,000
,, United States ...	120,000	152,000	+ 32,000
,, France	14,000	23,000	+ 9,000
,, Denmark	41,000	485,000	+ 444,000
,, Germany	48,000	29,000	– 19,000
Iron and steel wire and manufactures thereof, other than nails.—			
Total	175,000	232,000	+ 57,000
From United Kingdom ...	84,000	122,000	+ 38,000
,, Germany	34,000	31,000	– 3,000
,, United States ...	5,000	—	– 5,000
,, Denmark	11,000	18,000	+ 7,000
Railway material.—			
Total	1,375,000	1,739,000	+ 364,000
From United Kingdom ...	742,000	163,000	– 579,000
,, United States ...	5,000	—	– 5,000
,, Belgium	611,000	1,008,000	+ 397,000
,, France	—	569,000	+ 569,000
Cars or trucks for railways or tramways.—			
Total	840,000	675,000	– 165,000
From United Kingdom ...	692,000	600,000	– 92,000
,, United States ...	17,000	4,000	– 13,000
,, Belgium	11,000	46,000	– 65,000
Rubber manufactures, other than tires.—			
Total	214,000	220,000	+ 6,000
From Singapore	68,000	128,000	+ 60,000
,, United Kingdom ...	40,000	53,000	+ 13,000
,, United States ...	5,000	6,000	+ 1,000
,, Japan	12,000	8,000	– 4,000

NOTE.—£1 = about 13 Ticals.

Three-Wire d.c. Distribution Networks.

Some Cost and Operation Comparisons.

By H. W. TAYLOR, A.M.I.E.E.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS.)

THE paper discusses the application of single-core, three-core, and triple-concentric cables laid in conduit, direct, and solid to the various parts of a three-wire d.c. network. It endeavours to show that, wherever it can be adopted, the most satisfactory network is that composed of single-core, lead-covered cables, the feeders being drawn into conduits and the distributors and services laid direct.

From the point of view of operation it is undoubtedly the best policy to use single-core cables for feeders, as advantage can be taken of their high current-carrying capacity, even though the rest of the network is made up of three-core or triple-concentric cables. The greatest advantage is the small amount of inconvenience caused to consumers under fault conditions, this being particularly evident when followed up by a similar type of distribution system.

Between three-core and triple-concentric cables there is not much to choose, any advantage resting with the three-core cable, whose maximum current-carrying capacity is rather higher than that of the triple-concentric cable. Joints on three-core cables are also simpler, but this is not so important on feeders where there are comparatively few; on distributors, however, the fact assumes much greater importance. The use of three-core cables is limited to sizes up to 0.5 sq. in., cable manufacturers being unwilling to guarantee larger sizes. This disadvantage is not shared by the triple-concentric cable.

In deciding the best method of laying feeders, the local conditions are always the governing factors, and will not be similar in every case. The type of roadway met with in the centre of a town, in which area the bulk of the feeder system will generally be situated, is often of a very different nature from that in the outlying districts, and this fact might warrant additional initial expenditure with a view to future saving in the event of probable faults and possible extensions. For this reason it is often considered advisable to incur a little more trouble and expense in drawing the feeders into conduits in order to reap, at some future time, the advantages derived from such practice, amongst which are:—(1) Rapid localisation and repair of faults. (2) Low cost of increasing the size of the feeder. (3) Saving on capital charges due to the possibility of installing a cable sufficiently large to cope with loads of the immediate future, thus avoiding having buried in the ground a large quantity of idle copper which is not then required and from which no return will be forthcoming for many years. (4) Less depreciation.

A fact that becomes quickly apparent when considering the laying of a cable direct in the ground is the ease with which such work can be carried out. There is no need for the same amount of preliminary caution to be taken as for laying a conduit track along a main road. The fact that an obstruction is easily passed by this method is often a deciding factor in its favour. The life of a lead-covered cable laid in good ground, such as clay or sandy soil, has not yet been determined, but the fact that such cables on being examined after 15 or 20 years' service show no signs of deterioration, would appear to indicate that their useful life is very considerable.

For feeder work full advantage can be taken of the high maximum permissible loading of the direct-laid cable. This might in some cases enable a smaller size of cable to be used than if it were to be laid solid or drawn into conduits. Two factors have to be borne carefully in mind when laying cables direct, *viz.*:—(1) Electrolytic action due to stray currents from other sources. (2) The corrosive action of certain types of ground.

The "solid" system was introduced by Messrs. Callender's Cable and Construction Co., Ltd., and marked a great advance on the methods previously employed. Practically the only occasion on which this system is used to-day is when local chemical or electrolytic action would be probable on a cable laid direct. Even when such a course is adopted, plain lead-covered cable is preferable to the vulcanised-bitumen sheathed cable, for the following reasons:—(1) The cost is lower. (2) The continuity of the lead sheathing is maintained where the rest of the system, following modern practice, is composed of lead-covered cables. (3) Similar cable may be used for drawing into conduits on other parts of the system, and so the amount of cable to be kept in stock is reduced. (4) Freedom from damage to other adjacent roadway works in the case of a prolonged leakage to earth. This is particularly liable to occur on single-core vulcanised-bitumen cables laid solid.

The costs of the various systems are given (in the original paper) for two types of roadway—namely, (*a*) setts on a 6-in. concrete foundation, and (*b*) waterbound macadam, but the depth of track required for each of these types of roadway will not always be the same for all methods of laying. The (author's) figures show that three single-core feeders are the cheapest to lay down. When this fact is considered, together with the technical advantages of this type of cable, there must be very exceptional reasons to cause any undertaking, not hampered by restricted road space, to adopt a multicore cable for feeder work. It is also apparent from the figures that the cheapest way to lay cables is direct in the ground. There is little to choose between the conduit and solid systems, but both are considerably more expensive to install than the direct system.

The first cost in laying down a feeder is not the only consideration. When provision has to be made for future extensions and when the cost of repairing faults in cables laid under certain types of roadway that are both expensive to excavate and to reinstate is borne in mind, a considerable ultimate saving will be effected by incurring the increased initial cost of the conduit system. The (author's) table shows, exclusive of cable, the portion of the original expenditure that will have to be reincurred when it is necessary to increase the size of the feeder and also that the harder the type of roadway, *i.e.*, the more it costs to excavate and reinstate, the more substantial are the benefits derived from the conduit system.

Owing to the ± 4 per cent. voltage variation at consumers' terminals stipulated by the Electricity Commissioners, the choice of the type of cable to be used for distributors is very rarely affected by the maximum current-carrying capacity, the size required depending upon the voltage-drop when the cable will be carrying the maximum current with which it will have to cope. Apart from the cost of various types of distribution systems, the most important factor is that of continuity of supply in case of breakdown, and in this respect distributors composed of three single-core, lead-covered cables, used in conjunction with a similar type of feeder, form the best arrangement. This is because a fault can occur on one core without either of the others being affected, a rare occurrence on a multicore cable. Should one of the live cables break down, this cable alone need be cut out (provided that, by so doing, excessive load would not be thrown upon the neutral cable), the consumers connected to the other "side" being in no way affected.

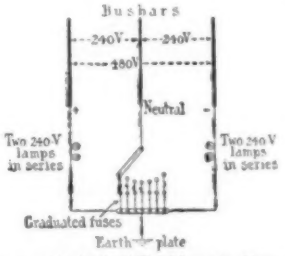


Fig. 1.—Method of Earthing the Neutral Bar at Substation.

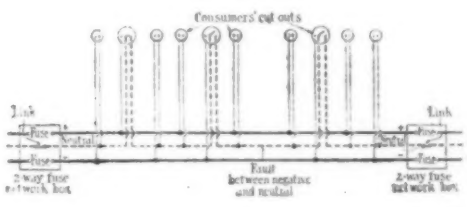


Fig. 2.—"Looped-Neutral" Services.

A simple earthing device at the station reduces to a minimum the possibility of even this partial disconnection, and at the same time diminishes the cost of network boxes by allowing the more simple and reliable link box to be substituted for the majority of the fuse boxes (see fig. 1). When an earth occurs on one of the "outers" it simply blows the light earthing fuse, and the neutral and other outer are respectively raised or lowered to 240 volts and 480 volts above or below earth potential, as the case may be. The system will therefore continue to operate with one of the outers earthed instead of the neutral. The Electricity Commissioners stipulate that such a fault must be cleared within 24 hours.

Due to the fact that the potential is removed from the fault when the light earthing fuse at the station is blown, very little damage is usually done to the cable, provided that water has not penetrated through to the insulation. It is very often found in such instances that a new piece of cable is not necessary, as the fault can be repaired by simply stripping back a portion of the lead covering and, after taping the damaged part of the insulation, sealing it up in a cast-iron joint box or lead sleeve. This considerably reduces the cost of making the repair.

When the actual repair of a fault on one of the cables is considered this system shows up to further advantage, because:—(1) The work can be left over, if desired, until such time when the least inconvenience will be caused to the consumers. (2) When locating the fault, only the faulty side need be disconnected. (3) The time taken to make a straight joint is very much less than with a multicore cable, and therefore the distributor can be put into commission again in a shorter time.

A further advantage of the use of single-core cables is that the numerous tappings taken off the distributors are more simple and easy to make and therefore more reliable. Also, when making such connections it is not necessary to make the cable dead. This has beneficial results, because there is no loss of revenue during the time the connection is being made, and no inconvenience is caused to consumers.

A network in which three-core cables are used for the distributors has not the same attractive features as those outlined in the system described above. The earthing of the neutral through a light fuse is unsuitable with such cables. The reason for this is that in a three-core cable, whilst it is possible to have a fault to earth on one live core without the others being affected, the time usually necessary for the trouble to spread and cause a short-circuit between cores is too brief for any material advantage to be gained by its adoption. It is thus necessary for the neutral to have some form of permanent earth connection and for suitable protection to be provided to operate on a fault to earth or between cores.

The protection of a distribution system is necessarily a compromise between conflicting conditions. On account of their low cost and simplicity, fuses installed in network boxes or pillars at convenient junctions of distributors are relied upon to isolate a faulty section. The inherent weakness of the fuse is, however, plainly demonstrated on heavy faults, when, due to its lack of discrimination, large healthy areas are cut off together with the bad ones. For this reason, fusing points should not be multiplied unnecessarily. Besides being more expensive, the introduction of fuse boxes in the place of link boxes decreases the reliability of the network.

As it is not necessary to cut any of the cores when a service connection is being made, the supply need not, in cases of urgent necessity, be interrupted during such time; but wherever possible it is better to make the distributor dead, as this allows the jointer to work in absolute safety and better workmanship is thereby obtained.

The triple-concentric cable has such obvious disadvantages for low-pressure d.c. distribution systems that it is remarkable that any undertaking ever adopted it for the smaller sizes of cables. It has most of the disadvantages of the three-core cable, as well as additional ones, against which it can only show a slight superiority in a reduction of cost and diameter. In addition, there are disadvantages arising out of the method of jointing. The outer cores have to be stripped back to give access to the inner core and it is essential to make the cable dead if due consideration is to be given to the jointer's safety. Furthermore, when the connection is taken off the inner core, definite gaps are left in the continuity of the outer and middle cores and these have to be bridged by special fittings, resulting in two soldered connections on each of these cores. However well these soldered connections are made, they can never be as reliable as the unbroken core of a three-core or single-core cable; moreover, joints have sometimes to be made under very adverse conditions which militate against good workmanship.

Tables showing the comparative costs of laying distributors under different types of ground surface and the approximate depths of track that have been allowed for in each case indicate that there is very little difference in the costs of three-core and triple-concentric distributors, whatever difference there is being due to the slightly higher cost of the three-core cable. There is thus no financial justification for the preference for the triple-concentric cable, with its inherent disadvantages.

The distributor made up of three single-core cables involves rather more expenditure than either of the other two, though this extra cost detracts very little from its manifold advantages, and, for the reasons already explained, the additional outlay is fully justified.

The chief factor in determining the size of a distributor is the maximum voltage-drop allowable so as to comply with the Electricity Commissioners' regulations of ± 4 per cent. variation in voltage. It is not, therefore, generally possible to take much advantage of the higher permissible current-carrying capacity of single-core cables, but it is well to remember that this good quality is a useful stand-by in cases of emergency when overloads may be temporarily thrown on to a particular distributor due to a breakdown at some other point of the network.

The following suggestion, the author considers, will greatly facilitate the location of faults on vulcanised-bitumen triple-concentric distributors up to about 0.2 sq. in. cross-section, and help to preserve the continuity of supply under fault conditions. As faults on modern cables are usually due to external causes, the majority of faults on a triple-concentric distributor are between the middle and outer cores, *i.e.*, between negative and neutral. This being the case, it is only necessary to cut the neutral core to enable a test to be taken that will show in which direction the fault lies.

If the neutral of the distributor is looped in at several of the services along its length, a convenient method of breaking its continuity is provided without any excavating being necessary, thereby effecting a considerable saving in time and money (see fig. 2). The fault having been traced to a position between two consumers in whose premises the neutral is disconnected, the supply can be restored to all the consumers with the exception of those tapped off the faulty length. If the fault be between all three cores the positive and negative cores should be bridged at the network box and only one fuse replaced. Where it is decided to adopt this system on an existing distributor that is not already supplying all the possible consumers, it can be installed whenever a suitable service is being laid, so that no scrapping of existing material is necessary.

The increased cost of such services depends upon their length and the size of the distributor, and amounts to from 25s. to £2 for short services. The saving in the event of one fault may cover the extra cost of many looped services.

The following conclusions may be drawn as to which is the most suitable system to be laid down, taking into consideration first cost, future extensions, load migration, maintenance, and continuity of supply:—

For feeders.

(1) Three single plain lead-covered cables drawn into watertight earthenware conduits.

(2) Where future load has not to be provided for and where the feeder can be laid in good soft ground and free from the danger of electrolysis, three single armoured cables laid direct would be suitable.

(3) Where the authorities have not much road space available, a three-core lead-covered cable may be drawn into conduits, but this will forfeit the special advantages of single-core cables.

Where a multicore cable is desired larger than 0.5 sq. in. or 0.25 sq. in. × 0.5 sq. in., a triple-concentric cable is necessary.

For distributors.

(1) Three single lead-covered steel-tape-armoured cables laid direct with tile covering.

In a locality where there is a danger of electrolysis, plain lead-covered cables should be substituted for armoured cables and laid solid in separate earthenware troughing with tile covering.

(2) Where the feeder system is three-core or triple-concentric, three-core distributors could be used, as most of the advantages of single-core distributors depend upon the whole system being made up of a similar type of cable.

Triple-concentric distributors should be avoided.

For services.

A type of cable similar to that used for the distributors. If the distributor is laid solid it is often more convenient to lay armoured services direct in the ground.

Discussion in London.

Mr. W. E. HIGHFIELD, who opened the discussion, pointed out that the mechanical and insulating protections of feeders and distributors were essentially different. Three-core cable up to the size in which it could be purchased had much to recommend it; in towns the use of three single-core cables had advantages, and triple-concentric cable had more uses than the author was apparently prepared to give it. The author had slightly overstressed the full-load rating. Bitumen could be poured without air bubbles if the precaution was taken of sprinkling a layer of fine sand (say, 1/16th in.) on the bottom of the trough. The paper was of much practical value.

Mr. H. A. RATCLIFF, a member of the Buried Cables Committee, remarked that it was not possible to accurately determine the current-carrying capacity of cables in towns where the nature of the soil varied greatly. He advocated the use of a mid wire of the same cross section as the two outers; that might be regarded as unorthodox, but the firm with which he was connected had used the idea. More trouble arose, he thought, from unbalance than from voltage drop. The reason for the shifting of the "nodal" point of a system was not very obvious, and it might be due to a variety of causes. He agreed that the choice of the size of a feeder cable was largely an economic rather than an electrical problem, and expediency was of more importance than any other factor. He thought the factor "T" in the calculations in the paper somewhat cumbersome. It was often very difficult to lay conduit in cities, and sometimes impossible; except in the case of telephone cables, conduit had very little real advantage in the case of feeders, and the cable inside often failed at the joints of the conduit; the latter also afforded a path for water and enabled gases to accumulate. In some cases steel tubes were useful, but expensive. For wood troughing he could not say anything bad enough, and the bonding and earthing of all lead-covered cables had not been mentioned in the paper. Triple-concentric cable had little real advantage; the author's case for single-core cable was largely based on pushing up the current density, but that would make the peak-load losses prohibitive in any length of cable.

Mr. O. L. W. TERRIMAN stated that the testing wire suggested by the author was also applicable to triple concentric cable, for which more could be said than the author had indicated; with it fault currents to earth were a minimum, and he favoured that type armoured and laid direct. The only advantage of single-core cable was that new con-

umers could be added without inconveniencing the old ones when making the joints, but that could also be done with concentric cable, although it was not advisable.

Mr. E. AMBROSE said that 3-core cable of 0.5 sq. in. was large, and there would not be many cases when a larger one would be needed. There were many reasons why conduit was desirable; it might be arranged with suitable inclination to form a drainage system, but perhaps that was idealistic. Lead-covered and braided cable was not troublesome to draw out of conduit, and even after the braiding had rotted, there was plenty of room, as no one would wish to use conduit smaller than 3 in. internal diameter. He did not like earthing the neutral at a station; it would be preferable to connect the neutral solidly to earth through a resistance shunted with a breaker and ammeter. If they must have armouring, then wire was much superior to tape.

Mr. F. C. RAPHAEL said he would like to know on what experience some of the statements in the paper were based. The author's comparison of the costs of different systems, resulting in the figures being practically the same, was based on enormously different ratings; basing it entirely on current-carrying capacity gave no useful comparison, and such "easy" tables as the author's should not be published in the I.E.E. *Journal* in their present misleading form. The "solid" system was a bit out of date, except in some few special cases, and the use of three single-core cables was in no way better than one 3-core cable from the point of view of the "other side" being affected under fault conditions. No one would put fuses in the neutral; it was impossible and, moreover, the earth ammeter should not be relied upon. Periodical tests, taking into consideration the insulation of the neutral, should be made, and he was sure that the ammeter was never intended to take the place of such tests. Callender's 3-core cable of special section was interesting, but he did not know that it had often been found necessary. He did not like the idea of looping the neutral into consumers' premises, and had felt bound to point out that the paper contained fallacies.

Mr. H. BRAZIL was of the opinion that the continuity of consumers' circuits should be preserved at any cost; they should not encourage cutting one off in order that his neighbour might be connected. He described means of reclosing breakers in sound circuits and isolating the faulty line.

Mr. J. S. HIGHFIELD suggested that it was illegal for the author to enter consumers' premises in order to test his mains in the manner advocated in the paper.

Mr. J. C. WIGHAM said that in his Table 3 the author had compared various types of cable incorrectly, and he would have to make three wiped joints instead of one only if he used 3-core cable. With the looped-neutral method presumably testing would be carried out with the current on, and therefore the cable could not be cut in two places

Mr. P. M. BAKER supported other speakers' criticism of the comparison of costs in the paper. Voltage drop was the only fair basis of comparison, as in no case was a cable loaded much over a quarter of its capacity. The cost tables were misleading, and the author had gone astray by overlooking practical considerations.

Mr. H. W. TAYLOR, in reply, remarked that the use of a neutral wire of equal size to the outers would be very convenient for the mains engineer, but the current carried did not necessitate it. If cables could not be laid "solid" in wet weather, they would never have had any cables at all in Scotland. With due respect to Mr. Raphael, graded fuses were used in the neutral, and with regard to Mr. Highfield's suggestion of illegality, consumers were only too willing to allow their premises to be entered for testing purposes if by so doing they assisted in the restoration of the supply. He would reply fully to the criticism in the *Journal*.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "J. C. White" Multiway Joint Box.

In the notice of this new device on p. 999 of our issue of December 26th, the reference to three twin 0.029 cables should have read "three twin 3/0.029."

"Statter" Circuit Breakers.

Two new designs of circuit breakers have recently been produced by MESSRS. J. G. STATTER & CO., LTD., Queen Anne's Chambers, Westminster, S.W.1. The larger type (fig. 1) is designed for currents of from 600 to 6,000 A, and orders for this have recently been received from four London supply companies, Manchester and Birmingham Corporations, and the Admiralty. Many important orders have also been received for the smaller pattern (fig. 2), which is produced for currents of from 25 to 1,000 A.

Both types of breaker are fitted with free-handle mechanism of the toggle type, closing a laminated copper brush upon flat copper contacts. It will be seen from the illustrations that the contacts are readily accessible for cleaning, and the method by which the brushes are squeezed down upon the contacts gives a rubbing action to the laminæ of which the brush is constructed, thereby rendering the contacts self-

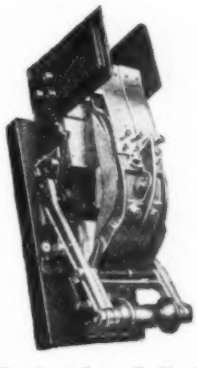


Fig. 1.—"Statter" Circuit Breaker for 600-6,000 A.

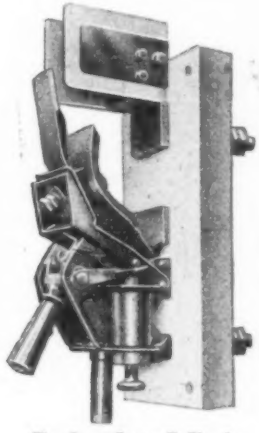


Fig. 2.—"Statter" Circuit Breaker for 25-1,000 A.

cleaning. The whole of the framework is well insulated from the current-carrying parts, and the proportions of the latter are liberal. The design is stated to satisfy the requirements of British Standard Specification No. 110/1923. The calibration range is from full load to twice full load.

A Stage Floodlight.

Amongst the new stage-lighting apparatus which is being placed at the disposal of illuminating engineering firms or departments, is the "Omnium" floodlight, depicted in fig. 3, which has been produced by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2. This can be mounted on a stand and used as a floor-type fitting,

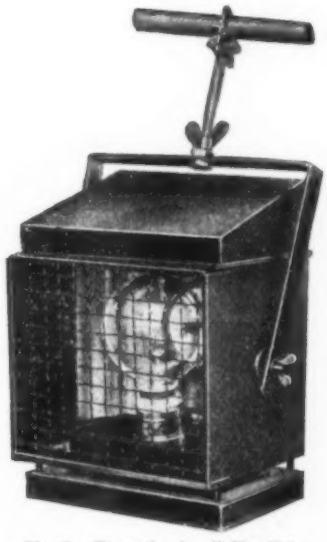


Fig. 3.—The "Omnium" Floodlight.

or it can be employed as a ceiling-type floodlight. In the latter case it can be used as a single unit or made up in a battery. Apart from its stage use, it can be employed for the lighting of ballrooms, or even in shop-windows which, after all, are a kind of stage on which are displayed a limited number of articles. It is very suitable for colour-lighting effects.

An Automatic Self-timing Toaster.

An interesting improvement in electric toaster design, the purpose of which is to eliminate burnt toast, has been patented by Mr. D. A. Rogers, 3101, Lyndale Avenue, So., Minneapolis, Minnesota. The main toasting element is of the standard type, with the time-controlling device built on one end, including a dial with four holes, each lettered, reminding one of an automatic telephone. Suppose one wants to toast some fresh bread; the slices of bread are placed in the wings of the toaster, and one dials "fresh bread." The dial revolves back to its normal position, being correctly retarded by a simple timing mechanism, the toast is done and the wings are automatically tipped back away from the

heating element; the bread is turned and the dial operation repeated. The holes in the dial are graduated—"Dry bread," "fresh bread," "medium fresh," and "extra fresh." The

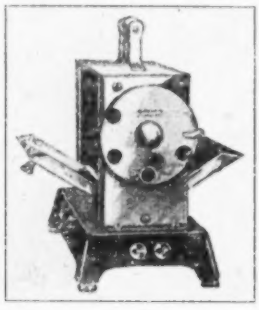


Fig. 4.—An Automatic Self-Timing Toaster.

hole nearest the top is for dry bread. The device is illustrated in fig. 4.—*Electrical News* (Toronto).

The "Hackney" Distributing Junction Box.

The demand for a junction box to reduce the cost of wiring and to simplify installation work has prompted Mr. P. M. SHEARS, of 19, Holmbury View, London, E.5, sales engineer of the Hackney Electricity Department, to design a fitting which appears likely to be extremely valuable in this connection. The box, which comprises a baseplate with cover, as shown in fig. 5, is of a rectangular shape, and is made of an insulating and fireproof compound. On the base are mounted two metal terminal blocks, divided from each other by an insulating partition. Each block is of square cross-section, having an opening in each end to receive a main

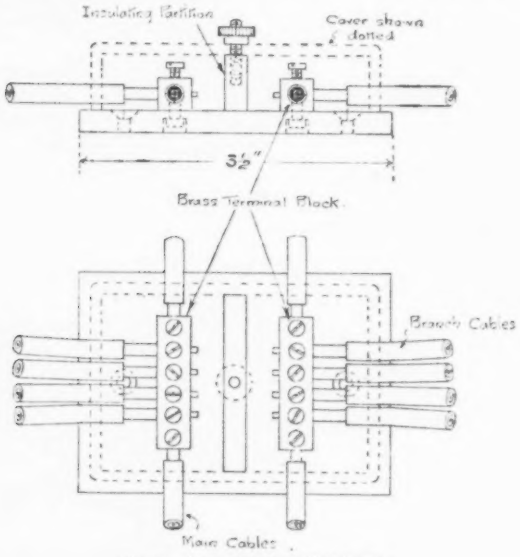


Fig. 5.—The "Hackney" Joint Box.

cable, and up to four openings in its long sides to receive branch cables; each opening is provided with a set-screw to clamp the conductor.

The box was primarily designed for use with single V.I.R. or rubber-sheathed cables, but with a suitable bonding cover it can easily be adapted for any metal-covered single-wire system. The extreme simplicity of the design, and the easy means of fixing the conductors, should render the box very useful, especially as the cost of production will be low, and its use should result in economy of wiring materials and labour. The box is not on the market yet, but the inventor has secured provisional protection, and is taking steps with a view to having it manufactured in quantity.

Heroic Rescues.—In September last while shafts were being sunk at the works of Messrs. Johnson & Phillips, Ltd., at Charlton, a man named Timpson was overcome by gas at a depth of 26 ft. and lay unconscious at the bottom. Several attempts at rescue were made; one of them by a foreman (Frederick Oliver) who was overcome and collapsed at the bottom of the shaft. While he and Timpson were lying unconscious, John Krull descended and succeeded in bringing both to the surface, the life of Oliver being saved in consequence. His Majesty has awarded the Edward Medal to both Krull and Oliver.

Published Specifications.

Compiled expressly for this journal by Patent Agents.

The name of the applicant's patent agent, if any, will be found on the publ... specification.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1923.

14,956. "Telautography or phototelegraphy." H. G. Bartholomew. Jun... 7th, 1923. (226,244.)

15,738. "Electrical contact maker." G. H. Atkin. June 18th, 19... (226,245.)

16,179. "Aerials for use in wireless signalling." C. S. Franklin. Jun... 21st, 1923. (Cognate application 22,484/23.) (226,246.)

16,305. "Method of and means for illuminating the identification ... of motor road vehicles." L. N. Chenhalls. June 22nd, 1923. (226,247.)

16,333. "Automatic regulator for electric, steam or hot-water radia... the same being also applicable for gas-heating, fire-alarm devices, refrigera... control, and other temperature control uses." R. Maclaren. June 23rd, 19... (Patent of addition not granted.) (226,249.)

18,330. "Electromagnets." E. B. Thurston. July 16th, 1923. (226,264.)

22,802. "Telephone exchange systems." Western Electric Co., Ltd. (... Deakin). September 11th, 1923. (226,265.)

23,272. "Coil employing a ball-and-socket joint." C. H. Clark. Septe... ber 18th, 1923. (226,273.)

23,340. "Amplifier for alternating currents." Signal Ges. September 18... 1922. (204,066.)

23,547. "Electrical leading-in conductors." H. G. Bell and Metropolit... Vickers Electrical Co., Ltd. September 20th, 1923. (226,284.)

23,552. "Electromagnetically operated sound-producer." H. W. Parke... September 20th, 1923. (226,285.)

23,621. "Dividing boxes for electric cables." W. C. Bexon and W. ... Upton. September 21st, 1923. (226,289.)

23,650. "Tuning stands for wireless apparatus." Igranic Electric C... Ltd., and A. H. Mackley. September 21st, 1923. (226,290.)

25,029. "Ventilation of electrical or other machinery or apparat... J. W. Young and Metropolitan-Vickers Electrical Co., Ltd. October 8... 1923. (Cognate application 31,744/23.) (226,305.)

25,030. "Vacuum electric tube devices." E. Y. Robinson, W. J. Bu... and Metropolitan-Vickers Electrical Co., Ltd. October 8th, 1923. (226,30...

25,137. "Telephone transmitters and receivers, loud-speaking telephon... and like sound converting and emitting devices." British Thomson-Houst... Co., Ltd., A. P. Young, and J. H. Butcher. October 9th, 1923. (Cogna... application 28,750/23.) (Patent of addition not granted.) (226,307.)

25,379. "Sound transmitting or emitting instruments." British Thomso... Houston Co., Ltd., A. P. Young, and J. H. Butcher. October 11th, 19... (226,310.)

26,198. "Storage batteries." R. E. Milnes. October 20th, 1923. (226,31...

26,204. "Electrical switches." F. Whipp, Whipp & Bourne, Ltd., and ... Mather & Platt, Ltd. October 20th, 1923. (226,312.)

26,341. "Systems of electric motor control." British Thomson-Houst... Co., Ltd. (General Electric Co.). October 22nd, 1923. (226,313.)

27,529. "Device for letting down the mica on a commutator of an electr... machine." F. Pape and J. H. Bennison. November 2nd, 1923. (226,3...

27,574. "Induction motors." W. A. Benger and F. & A. Parkinson, Ltd. November 2nd, 1923. (226,329.)

28,103. "Electrical connecting devices for wireless receiving apparatus." F. Milborne. November 8th, 1923. (226,335.)

28,347. "Telephone and like electrical transmitting systems." Western Electric Co., Ltd. (Western Electric Co., Inc.). November 10th, 19... (226,338.)

28,979. "Distributors for magneto-electric machines." British Thomso... Houston Co., Ltd., A. P. Young, and L. Griffiths. November 16th, 19... (226,347.)

29,415. "Radio receiving systems." British Thomson-Houston Co., Ltd. November 21st, 1922. (207,536.)

29,520. "Collapsible frame aerial." Sterling Telephone & Electric Co., Ltd., T. D. Ward-Miller, and W. M. Holbeach. November 22nd, 19... (226,353.)

29,555. "Incandescent electric lamps." T. Miyaguchi. November 22nd, 1923. (226,354.)

31,497. "Variable electric condensers, variometers, and the like." W. H. Gaskell and A. F. Holliday. December 15th, 1923. (Cognate application 7,537/24.) (226,365.)

32,290. "Tramway or other suitable rail joints." J. T. Simcox. Decem... ber 27th, 1923. (226,369.)

1924.

4,742. "Electric heating apparatus." Snead & Co. May 16th, 19... (216,699.)

7,723. "Manufacture of electric cables." B. Kolanczyk. March 26th, 19... (Addition to 218,975.) (226,412.)

8,571. "Thermionic valve circuits for wireless systems." K. D. Rog... and G. V. Dowding. April 4th, 1924. (Cognate application 9,204/24.) (226,417.)

9,251. "Electrical resistors." Metropolitan-Vickers Electrical Co., Ltd. May 7th, 1923. (215,728.)

9,444. "Current motor." P. G. Piper and L. Ferreiros. April 14th, 19... (226,423.)

9,461. "Connection of electric conductors." Soc. Anon. Le Carbone. December 6th, 1923. (225,808.)

9,805. "Methods of and means for operating electric resistance furnaces." British Thomson-Houston Co., Ltd. (General Electric Co.). April 17th, 19... (226,425.)

10,289. "Electrolytic meters with multi-stage indicators." Siemens-Schuckertwerke Ges. April 26th, 1923. (215,009.)

10,803. "Apparatus for transforming electric currents." S. Saikawa. May 1st, 1924. (226,426.)

11,558. "Systems of receiving and indirectly amplifying radio-frequency electrical oscillatory energy." W. J. Mellersh-Jackson (Westinghouse Electric and Manufacturing Co.). May 9th, 1924. (Convention date not granted.) (215,785.)

12,984. "Method and apparatus for electrically heating metal bands." E. Schroder. May 27th, 1924. (226,437.)

13,129. "Electric arc furnaces." I. Rennerfelt. May 28th, 1924. (226,43...

14,883. "Electric condensers and method of manufacturing the same." H. Barengolz. June 26th, 1923. (218,281.)

18,985. "Spiral tungsten filaments." General Electric Co., Ltd. February 14th, 1924. (226,455.)

20,700. "Loud-speaker receivers for line or wireless telephony." C. Parolini and G. Perron. October 4th, 1923. (222,643.)

21,302. "Brush-shifting alternating-current motors." British Thomson-Houston Co., Ltd. September 10th, 1923. (221,806.)

24,247. "Automatic or semi-automatic telephone systems." Automatic Telephone Manufacturing Co., Ltd., R. Mercer, and F. Tench. September 18th, 1923. (Divided application on 23,378/23.) (226,467.)

24,248. "Automatic and semi-automatic telephone systems." Automatic Telephone Manufacturing Co., Ltd., R. Mercer, and F. Tench. September 18th, 1923. (Divided application on 23,378/23.) (226,468.)

26,983. "Method of producing rail bonds for electric railways." W. C. Fairweather (Embru-Werke Akt. Ges.). May 13th, 1924. (Divided application on 235,776.) (226,471.)